HITCHCOCK'S Machine Tool BLUE BOOK

FOUNDED **FEBRUARY 1940** 1905

Fifty Years of Precision . . . from the original Hardinge design to the present modern Hardinge High Speed Precision Ball Bearing Second Operation Machine.

Fifty Years of Improvements . . . until today the Hardinge Enclosed Head Preloaded Ball Bearing Second Operation Machine mounted on the new welded steel pedestal is the answer for Accuracy . . . Fine Finish . . . High Speeds . . . Low Cost.

Are you making the common and expensive mistake of using a complicated, higher priced machine, capable of doing many things—for second operation work only? If you are, you should change to a Hardinge Second Operation Machine for economical production.

Or better still, actually try one of these machines to determine the merits. One manufacturer who tried a Hardinge Second Operation Machine discovered such definite economy that sixty of these money saving machines have since been installed.

Let us show you the result of Fifty Years of Precision Progress embodied in the new Hardinge "Cataract" Second Operation Machine. Ask for our new eight-page Bulletin HSM.

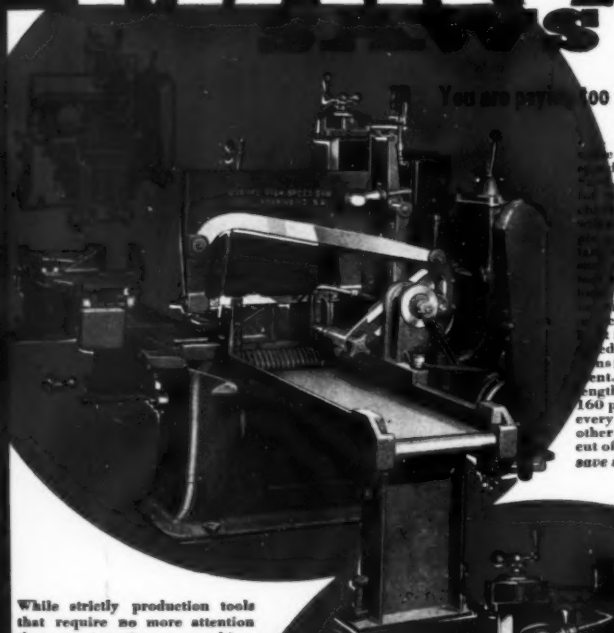
HARDINGE BROTHERS, Inc., ELMIRA, N. Y.
CHICAGO—NEW YORK — HARTFORD — PHILADELPHIA — CLEVELAND — DETROIT

Precision Since 1890

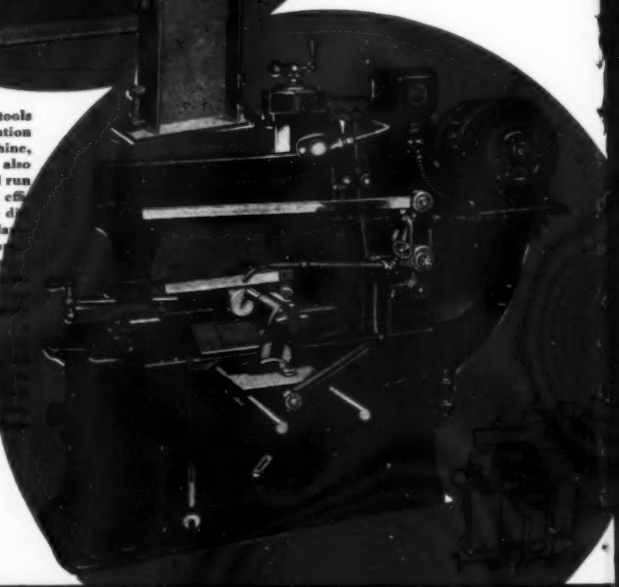
MARVEL

Saws

You are paying too much for cutting-off



. unless you have one or
new heavy-duty, super high
MARVEL Automatic Hack
you are paying too much
utting-off. No other ma-
of comparable accuracy
t off an equal number of
from bar stock in diame-
10" with such speed, at
ow labor cost, power cost,
ost or with such small chip
Far heavier, and all ball-
ng, these MARVEL auto-
Saws No. 6A and 9A are
for continuous operation at
eds and feeds and blade ten-
ns impractical for other equip-
ent. They will cut off identical
engths, 10 pieces of 6" round,
160 pieces pieces of 1½" round
every hour floor-to-floor, and
other sizes proportionally. They
cut off squarely and accurately—
save stock and machining.

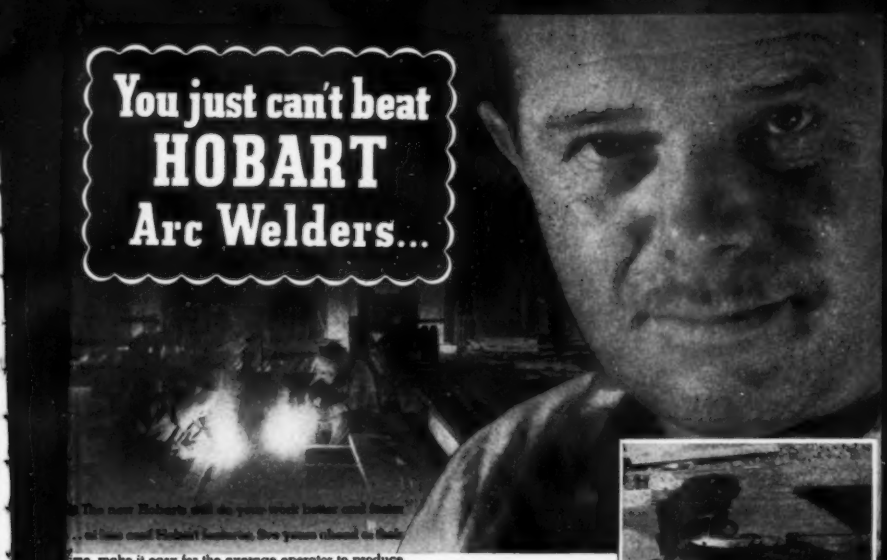


While strictly production tools that require no more attention than an automatic screw machine, MARVEL Automatics are also multi-purpose; will handle all run of the shop sawing easily and effi ciently—bar push-up can be di engaged at any point, miscella ous cuts made, and automatic o ation resumed by re-engageme the bar feed drive. For misc neous sawing where the nu of identical pieces does not j an automatic bar push-u MARVEL No. 6 or No. 9 wil the same low cost, high performance. Available with speed belt drive, 4-speed drive, single speed motor o or motor drive with 4-speed t mission.

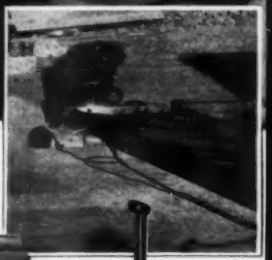
Send for catalog.

ARMSTRONG-BLUM M. ICAGO

You just can't beat HOBART Arc Welders...



...The new Hobarts will do your work better and faster ... at less cost! Hobart's features, five years ahead in their time, make it easy for the average operator to produce high quality welding. He can get exactly the right current and voltage he needs . . . the Multi-Range Dual Control gives him finger-tip control at the job of 1,000 possible combinations of welding heat. The Hobart Simplified Welding brings substantial savings in labor and current costs. It assures better quality welds . . . fewer rejects. Could anyone ask more of an arc welder?



Above illustration shows you how efficient Hobart Welders are adapted to heavy production welding.

THAT'S WHY IT'S THE FASTEST SELLING ARC WELDER ON THE MARKET TODAY! But don't take our word for the extra economies and profit possibilities of the New Hobart Arc Welder.... don't take anyone's word! Learn first-hand the money-saving advantages of the Hobart Welder. Try this new welder for thirty days on your own work, in your own shop . . . at Hobart's risk!

Hobart Bros. Co.
Box TB-240 Troy, Ohio
"One of the World's Largest Builders of Arc Welders"

Remote Contr
An exclusive Hobart feat
that permits the operato
get the right setting of w
ing heat at the job, with
leaving his work. It's just
other big Hobart advanta

30 Days Tri
on your own work,
at Hobart's risk!

USE THE COUP

RT also builds A.C. ARC WELDERS for single phase lines

You're Money Ahead with

Hobart

SIMPLIFIED ARC WELDING

Hobart Bros. Co., Box TB-240, Troy, Ohio

Send complete information about the New Hobart Multi-Range Arc Welder, without obligation.

☐ Electric Drive ☐ Gas Drive ☐ "Build Your C
☐ AC Welder I'm interested in ..... cap

To be used for .....
Details on ☐ 30 Days Trial ☐ Easy Terms ☐ Handling (with purchase pri

NAME .....

ADDRESS .....

NILSON *Automatic*

METAL AND WIRE

Forming Machine

This Ribbon Stock forming machine is a Nilson contribution to the high-geared production requirements of today's industry. Engineered with a fifty-year background of experience in designing and building metal forming machines, this 2-3-F machine is setting new records in speed and uniformity of products.

SOME FEATURES OF THIS FOUR-SLIDE FORMING MACHINE

- Open construction of the press and forming tools.
- Patented slide lead with an independent cam-operated wire gripping device.
- Power operating wire feed is two-speeded through a straight line.

Write for information on all types of metal forming machines.

The **A. H. NILSON** *Machine Co.*

BRIDGEPORT, CONN., U. S. A.

HANNIFIN CYLINDERS BORED AND HONED *for High Efficiency Performance*

Model JR—double-acting air cylinder

Model BR—double-acting air cylinder

Model CR—double-acting air cylinder

ALL Hannifin Pneumatic Cylinders are bored and then honed, producing a straight, round, and perfectly smooth cylinder finish. High efficiency piston seal is easily maintained throughout the entire life of the packing, for the soft, graphite-treated piston packing is adjustable from outside the cylinder without disturbing any other parts. This construction not only prevents leakage and waste of air power, but also means minimum friction loss and maximum usable air power.

Hannifin Cylinders are built in a full range of standard types, sizes 1½ to 16 in. diameter, for any length stroke. Larger sizes built to order. Single or double acting types, with or without air cushion.

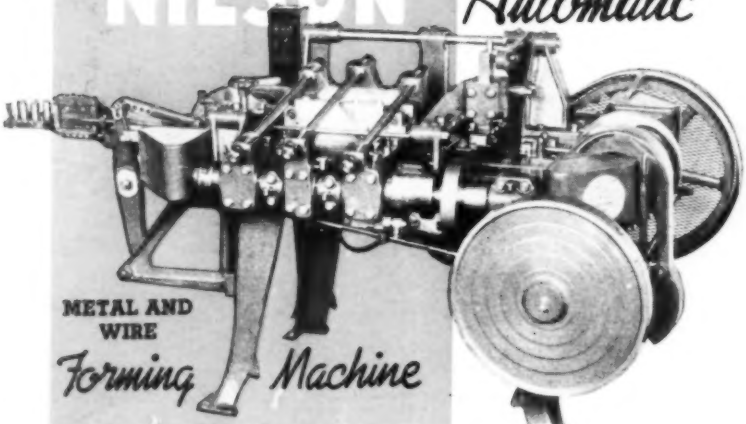
Write for Bulletin 34-H, also Bulletin 35-H on Hydraulic Cylinders.

HANNIFIN MANUFACTURING COMPANY
621-631 South Kolmar Avenue • Chicago, Illinois

ENGINEERS • DESIGNERS • MANUFACTURERS
Pneumatic and Hydraulic Production Tool Equipment

HANNIFIN
HIGH EFFICIENCY AIR

NILSON *Automatic*



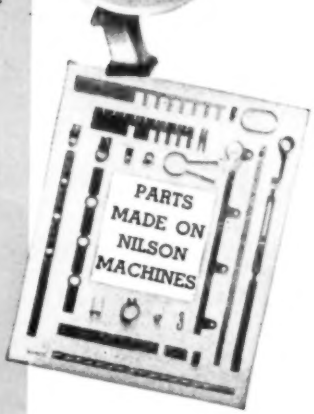
METAL AND WIRE *Forming Machine*

This Ribbon Stock forming machine is a Nilson contribution to the high-geared production requirements of today's industry. Engineered with a fifty-year background of experience in designing and building metal forming machines, this S-J-F machine is setting new records in speed and uniformity of products.

SOME FEATURES OF THIS FOUR-SLIDE FORMING MACHINE

- **Open construction of the press and forming tools.**
- **Patented slide feed with an independent cam-operated wire gripping device.**
- **Power operating wire feed is transmitted through a straight line.**

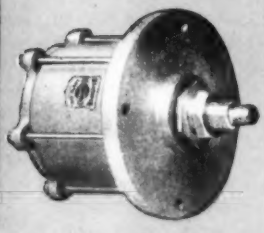
Write for information on all types of metal forming machines.



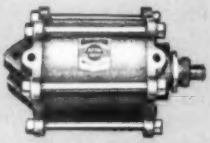
The A. H. NILSON *Machine Co.*

BRIDGEPORT, CONN., U. S. A.

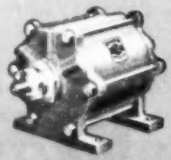
HANNIFIN CYLINDERS BORED AND HONED *for High Efficiency Performance*



Model JR—double-acting air cylinder



Model BR—double-acting air cylinder



Model CR—double-acting air cylinder

ALL Hannifin Pneumatic Cylinders are bored and then honed, producing a straight, round, and perfectly smooth cylinder finish. High efficiency piston seal is easily maintained throughout the entire life of the packing, for the soft, graphite-treated piston packing is adjustable from outside the cylinder without disturbing any other parts. This construction not only prevents leakage and waste of air power, but also means minimum friction loss and maximum usable air power.

Hannifin Cylinders are built in a full range of standard types, sizes 1½ to 16 in. diameter, for any length stroke. Larger sizes built to order. Single or double acting types, with or without air cushion.

Write for Bulletin 34-H, also Bulletin 35-H on Hydraulic Cylinders.

HANNIFIN MANUFACTURING COMPANY
621-631 South Kolmar Avenue • Chicago, Illinois

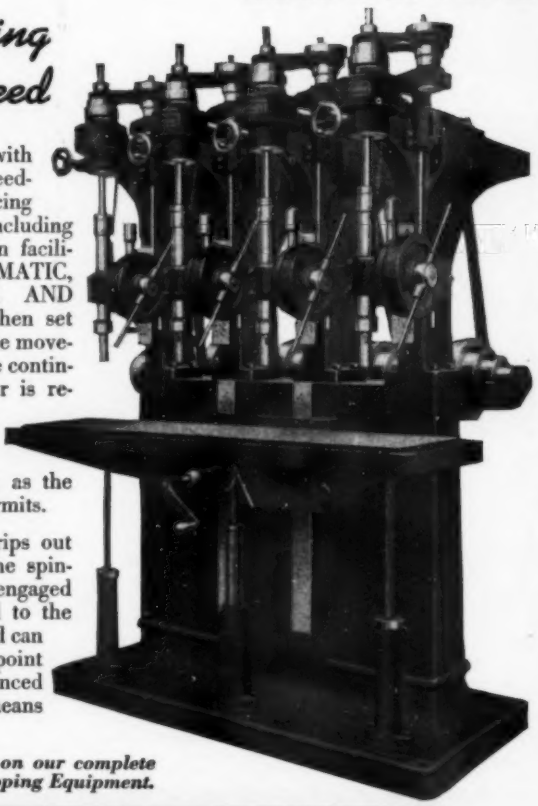
ENGINEERS • DESIGNERS • MANUFACTURERS
Pneumatic and Hydraulic Production Tool Equipment

HANNIFIN

HIGH EFFICIENCY AIR CYLINDERS

Avey-matic DRILLING MACHINE

Ball-Bearing High Speed



A modern Machine with a modern design of feeding mechanism embracing distinctive features, including recent developments in facilities for FULL AUTOMATIC, SEMI - AUTOMATIC AND HAND-FEEDING. When set for full automatic, all the movements of the spindle are continuous, and the operator is required only to change the work under the spindle and can operate as many spindles as the nature of the work permits.

The semi-automatic trips out the feed and returns the spindle, but the feed is reengaged by advancing the drill to the work by hand. The feed can be disengaged at any point of the stroke or advanced ahead of the feed by means of the hand-lever.

Send for information on our complete line of Drilling and Tapping Equipment.

Avey for QUALITY ECONOMY DEPENDABILITY

THE AVEY DRILLING MACHINE CO.

CINCINNATI, OHIO, U. S. A.

Spring tempered COLLETS

Order From Stock

Scientifically heat treated to a true spring temper, "Rivett Mark" collets resist wear and hold their spring longer than collets of any other make. As standard equipment on all makes of lathes and millers, (see Rivett Bulletin 1008) they may be ordered for immediate delivery from the following stocks:—

CHICAGO
R. E. Ellis Engineering Co.
565 W. Washington Blvd.,

DETROIT
Charles A. Strelinger Co.
149 E. Larned Street

BOSTON
Rivett Lathe & Grinder Inc.
18 Riverview Road, Brighton

RIVETT LATHE & GRINDER INC.
BRIGHTON, BOSTON, MASS.

MORRISON

OLLETS • FEED FINGERS • PADS • FORM TOOLS

THERE IS NO SUBSTITUTE FOR EXPERIENCE"

THE COLLETS WITH SURE-GRIP RECTANGULAR SERRATIONS

For twenty-one years, the Morrison Machine Products have manufactured nothing but collets, feed fingers, pads and form tools for screw machines. This continual concentration means experience resulting in improved performance and satisfaction to many users —better your screw machine production by specifying Morrison products.

Morrison

COLLETS FEED FINGERS *and* PADS

FOR YOUR AUTOMATIC AND HAND SCREW MACHINES

andard round, xagon and uare collets, ed fingers and ds are carried stock for im- diate delivery for use th your Brown&Sharpe, eveland, Cone, Gridley, tional Acme, New Brit- , Davenport, Bardons Oliver, Cincinnati, ster, Garvin, Pratt & hitney and Warner & Swasey rew machines.

ou have information on our master feed fingers and pads h eliminate scoring of stock? Those with adjustable tension and master collets and pads without objectionable screw threads?

Ask for our complete catalog No. 34.

MORRISON MACHINE PRODUCTS

DIVISION HARDINGE BROTHERS, INC.

ELMIRA N. Y.

SKILSAW TOOLS
are used to improve workmanship, reduce costs in building the famous precision machines of
EX-CELL-O CORPORATION
• Drilling holes for name-plate in the side of an Ex-Cell-O Precision Boring Machine—using a SKILSAW 5/16 in. capacity Drill.
• Finishing a side-pad on the table of an Ex-Cell-O Precision Boring Machine—using a SKILSAW Model "B" Belt Sander.
• Counterboring a hole in an Ex-Cell-O Precision Thread Grinder base—using a SKILSAW ¾ in. capacity Drill.

Every one of these operations—so slow and costly when done by hand—is made fast and profitable by the use of SKILSAW TOOLS in the plant of Ex-Cell-O Corporation at Detroit, well-known as one of America's finest manufacturers of precision machinery.

In every industry, SKILSAW TOOLS are used to step-up production, reduce costs and improve workmanship. They are preferred because they're designed and built to the most exacting precision standards . . . to give long years of dependable, trouble-free operation. Ask for a FREE demonstration on your own work. Sold by leading mill supply distributors.

SKILSAW

SAWS · BELT SANDERS · GRINDERS · SURFACERS
DRILLS · DISC SANDERS · FLOOR SANDERS

SEE YOUR DISTRIBUTOR ... he will gladly demonstrate how SKILSAW TOOLS will save you money

SKILSAW, INC.,

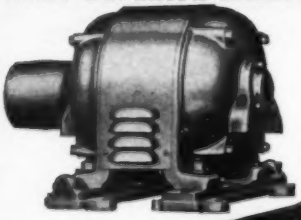
5035 Elston Avenue, Chicago, Ill.

64 East 22nd St., New York—182 Main St., Buffalo—52 Brookline Ave., Boston—18 S. 7th St., Philadelphia—2126 Main St., Dallas—918 Union Street, New Orleans—1253 South Flower St., Los Angeles—2945 Webster Street, Oakland—29 North Ave., N. W., Atlanta—
Canadian Branch: 85 Dufferin Ave., Toronto.

U. S. LUBRIFLUSH *purges* Motor Bearings

GUN
THE NEW WAY
U. S. Lubriflush method cleanses bearing of old, devitalized lubricant by forcing new lubricant through bearing.
THE OLD WAY
No way is provided for purging the bearing of old, devitalized lubricant. New lubricant merely passes by the bearing.
Patent Pending
Removable plug for draining

Most advanced method of thoroughly cleansing bearings



U. S. Lubriflush allows new lubricant to be introduced to the innermost recesses of the bearing, forcing the old, worn-out lubricant from the bearing and out of the motor through a bottom drain. The bearing is purged of sludgy, devitalized grease, and renewed with clean lubricant. Bearing life is greatly increased.

SEND FOR BULLETIN

Bulletin describing Lubriflush system in comparison with ordinary motor bearing lubrication mailed on request.

U • S • MOTORS

REQUEST FOR LUBRIFLUSH BULLETIN

U. S. Electrical Motors, Inc.
78 34th St., Brooklyn, N. Y.

Gentlemen:

☐ Mail U. S. Lubriflush Bulletin ☐ Mail U. S. Motors Bulletins

Name_____

Address_____

City_____ State_____

THE CASE of the AIRCRAFT FORGING . . . . . solved by KELLERFLEX

Here are three Kellerflex JB-1 machines used in a prominent drop forge shop to remove scale from forgings preparatory to a microscopic inspection of the metal. Notice how easily Keller Burs clean up the corners and grooves.

THE aircraft industry must maintain rigid inspection standards—lives depend on them. Every forging must be free from cracks and defects. That is where Kellerflex Flexible Shaft Equipment solved the problem.

As forgings leave the hammers, excessive scale is removed quickly with Kellerflex. Then it is an easy matter to detect immediately all cracks and defects, through a microscopic visual inspection.

Kellerflex has many other applications in the forge shop. These powerful little machines are used in fitting, altering, cleaning and finishing die blocks, removing rough edges and burrs from forgings, cleaning and sanding forgings, and hundreds of other operations.

We will be glad to send you complete information on Kellerflex Machines and equipment.

HEADQUARTERS
for the finest of
Flexible Shaft Equipment

PRATT & WHITNEY

DIVISION NILES-BEMENT-POND CO. • HARTFORD, CONN.

Kellerflex Sales Department

The Utility Sleeve

SAVE MONEY WITH THESE

UTILITY Tools

You can cut small tool costs with a UTILITY SLEEVE—a removable taper shank tool driver that saves at least 40% (some customers report 75% savings). It is used with taps, drills, countersinks, reamers, end mills, center drills, counterbores, woodruff cutters, taper pin reamers, etc. The sleeve is a two jaw collet in action, fitting over the diameter of the shank of tool, which is positively driven by flats or the tang on shank end.

A test in your own plant will quickly prove the superiority of the UTILITY Friction-less LIVE CENTERS. They are made for the smallest tool room lathes, as well as the largest railroad shop equipment. Large taper thrust and annular roller bearings, precision mounted, assure accuracy and long life under severe conditions. Front bearing cone seats on resilient pad —a shock absorber that protects against tool breakage or spoilage of work. Available in Taper Shank, Slip-in, Slip-over & Spindle Types.

The PRECISION "Center of Centers"

Utility Tools

Special bulletins give full information on Utility Tools. Check the ones in which you are interested, pin to letterhead and mail.

Floating Holders
Countersinks
Spot Facers
Sleeves
Live Centers
Counterbores
Core Drills
Reamers

Pin to letterhead and mail Now!

Send for bulletins giving full information—also details of our 30-day Free Trial Offer.

The J. C. GLENZER CO., Inc.
6465 Epworth Blvd.
DETROIT. MICH.

comes now . . .

SPEED *of control* in HYDRAULIC OPERATIONS

Speed of reaction without sacrificing efficiency is now being had by pneumatically controlling hydraulic power valves. There is an important saving in reaction time of pneumatic controls over the comparatively slower hydraulic reaction in identical circuits.

T-J Pneumatic Remote Controls provide full advantage of this saving also in that their variety of unit types permit their application to your requirements to be of standardized equipment.

Bulletin number RC-4 reports on the high points of these systems in this application type as well as in many others in which they are being successfully and increasingly used. Your copy will be sent promptly upon receipt of your request.

T-J Controls are shown here on a T-J Hydraulic Rivitor. Developed for riveting aircraft fuselage and wing sections, the operator's station is necessarily some distance from the power valve. T-J Pneumatic Controls provide the desired snappy reaction to the power valve.

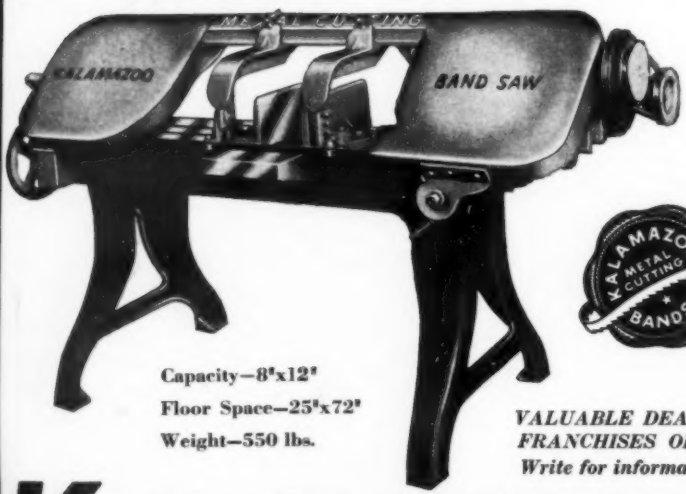
this is a **TOMKINS-JOHNSON** *product*

Factory at 605 N. Mechanic St., Jackson, Michigan

Agents in principal cities. T-J Products also include Air and Hydraulic Cylinders . . . Rotating Chucks and Cylinders . . . Rivitors . . . Clinchors . . . Special Equipment . . . Brownie Coolant Pumps . . . T-J Die Sinking Milling Cutters.

NEW

★ SIMPLIFIED CONSTRUCTION
★ SAFETY FEATURES
★ TIME SAVING INNOVATIONS
★ LOW PRICE



KALAMAZOO METAL CUTTING BANDSAW

Capacity—8"x12"
Floor Space—25"x72"
Weight—550 lbs.

VALUABLE DEALER FRANCHISES OPEN
Write for information

KALAMAZOO

METAL CUTTING BANDSAW

Here's the latest development in a horizontal cutoff band saw!—a carefully engineered design that provides these important features—

. . . enclosed dirt-proof gearing sealed for life
. . . hydraulic frame control . . . quick acting vise
. . . automatic cut off . . . automatic feed . . . standardized parts throughout. When caster mounted, you can use it anywhere!

Write for complete information today.

Kalamazoo T. & S. Co., Kalamazoo, Michigan

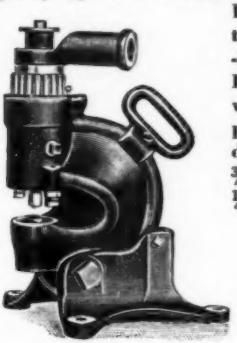
ESTABLISHED 1867

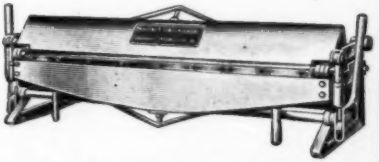
To All Sheet Metal Men

Gentlemen:

Here are just a few of the more than 80 different types of punches, presses, brakes and metal working equipment that are manufactured by Whitney. These are dependable items, perfected through long experience and close contact with the trade.

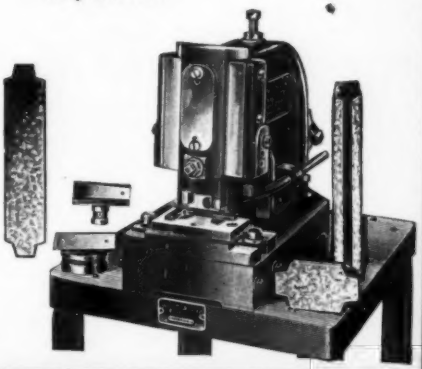
No. 40 Ball Bearing Punch — Capacity 5/8" hole through 5/8" iron. Depth of throat 3½" -Height 2". Furnished with one punch and die — sizes 3/8 to 1" by 1/16".





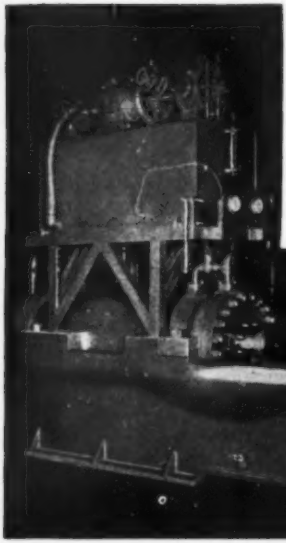
The bench type "Air Conditioning Special" Portable Brake can be converted into a floor type by the addition of a sub-base, attached with four bolts. It is quickly adjustable for different gauges — capacity 49" width, 20 ga. stock. Jaws are of welded steel plate, box type. Weight, only 265 lbs.

At the right is shown our regular No. 28 Foot Press equipped with notching punch and die for making drive cleats, used in air conditioning work. One customer says this equipment repaid its cost during the first month.



Send For Complete Whitney Catalog

WHITNEY METAL TOOL COMPANY
115 FORBES ST., ROCKFORD, ILLINOIS



No. 100 EXTRUDING PRESS

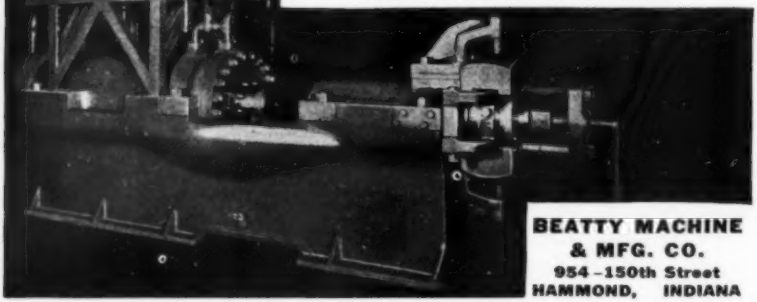
Seven Points of Superiority

1—A Self-Contained Unit. 2—Rigid One-Piece Frame, Eliminating Tie Rods. 3—Free Open Space for Loading Material Chamber. 4—Quick Opening Die Head for Cleaning. 5—Flexible Coupling Type Packing Head on Plunger. 6—Rapid Return Speed. 7—Greater Production.

These and many other desirable features will compel you to write for illustrated bulletin.

Beatty Manufactures a Complete line of Presses, Punches and Shears, along with many other types of heavy duty Machine Tools.

May we be favored with your inquiries?



BEATTY MACHINE & MFG. CO.
954-150th Street
HAMMOND, INDIANA

BOYAR-SCHULTZ
Profile Grinder

No. 1
Bench Model

Hundreds of users in America and abroad are saving time on expensive die and tool work that calls for grinding and fitting difficult shapes, contours and irregular profiles.

Not only is a great deal of time saved on these operations, but the quality of work turned out with Boyar-Schultz Profile Grinders is much better. Dies, tools and parts have that finished appearance that is the pride of the expert. Use the Bench Model for light work or the No. 2 Heavy Duty Model for larger and heavier work.

Write for circular giving full description and time saving possibilities.

BOYAR-SCHULTZ CORPORATION
2108 WALNUT STREET **CHICAGO, ILLINOIS**

UNEQUALLED FLEXIBILITY IN THIS NEW UNIVERSAL TAPPING MACHINE.

This New PROCUNIER Universal Tapping Machine is designed with a flexibility to meet *all* of your tapping requirements.

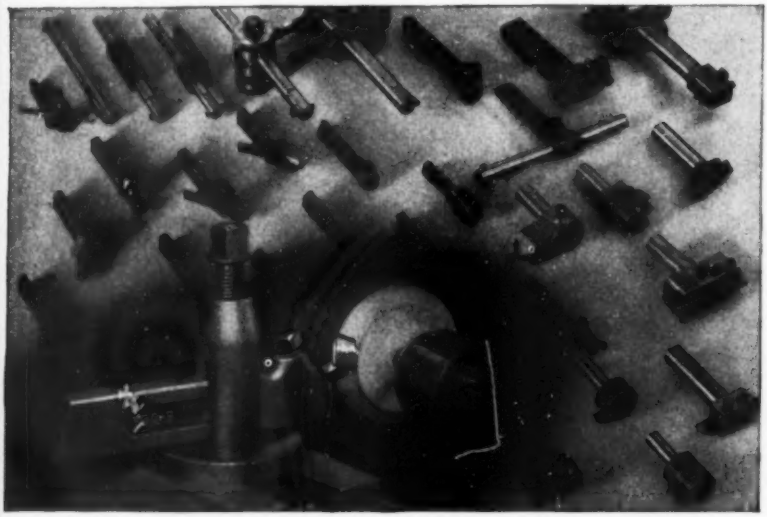
Use it for highly specialized production—
Use it on jobs requiring precision accuracy—
Use it for work involving a wide range of variations.

Whatever your needs, you'll find the PROCUNIER Universal offers you outstanding advantages and economies.

For further information on this cost-cutting tapping machine, send for your copy of our interesting bulletin No. 38.

PROCUNIER SAFETY CHUCK CO.
14 S. CLINTON ST., :-: CHICAGO, ILL.

ARMSTRONG



Step up your Tool Room schedule with more . . .

ARMSTRONG TOOL HOLDERS

The best solution for a jammed-up tool room is: More ARMSTRONG TOOL HOLDERS. With the right tool holders for every operation you can step up machine tool speeds and feeds far beyond the "standards" set in the old bar tool days.

The Armstrong System provides tool holders for every operation on lathes, planers, slotters and shapers—over 100 different sizes and shapes, each correct in design and proportion, correct in cutting angle and tool approach, each the most efficient tool available for its particular work, painstakingly worked out to give maximum clearance. Because ARMSTRONG TOOL HOLDERS are strong beyond need, handy and multi-purpose, there is a tendency in many shops to use a few tool holders for all types of work. This is false economy for the maximum efficiency can only be had with the correct type and correct size ARMSTRONG TOOL HOLDER for each operation and for each machine tool.

If you want to break the jam in your tool room, to turn out the same work in fewer machine hours, check the tool holders on lathes, planers, slotters, and shapers against the new C-39 catalog. Then, when properly tooled, step-up speed and feeds.

Buy ARMSTRONG TOOLS from your Supply House

ARMSTRONG BROS. TOOL CO.

"THE TOOL HOLDER PEOPLE"

308 N. FRANCISCO AVE., CHICAGO, U. S. A.

Eastern Warehouse and Sales: 199 Lafayette St., New York

ARMSTRONG TOOL HOLDERS Are Used in Over 96% of the Machine Shops and Tool Rooms

HITCHCOCK'S

MACHINE TOOL BLUE BOOK

28,000 CIRCULATION *FEBRUARY 1940* *VOLUME 35, No. 2*

CCA

THIS MONTH

Gear Hobbing
by Charles Staub 21

Cutting Off Tools
by J. Milton Luers 45

Standard Jig Applications
by F. J McGarry 57

Hardinge Brothers' Golden Anniversary 63

Solving Inspection Problems By Projection
by John W. King (part 11) 67

Broaching Reinforced Babbitt Bearings 77

The Editor's Page 19

New Equipment 81

Mechanics Through the Ages 167

The Mail Bag 171

New Trade Literature 173

Buyers' Service 176

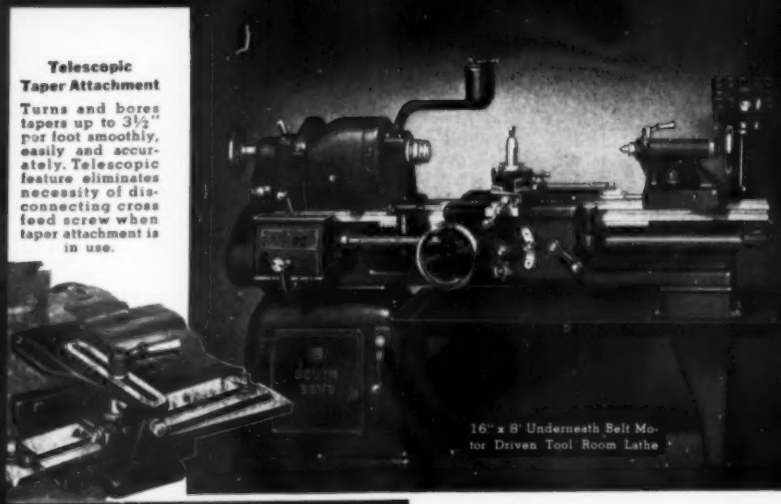
Index of Advertisers 209-210

Published Monthly by Hitchcock Publishing Company . . . 508 South Dearborn Street . . . Chicago, Illinois, U. S. A. . . . *Copyrighted . . .* *Geo. O. McKibben, President . . . J. E. Hitchcock, Vice President . . . Robert C. VanKampen, Business Manager . . . Wesley G. Paulson, Editor . . . M. L. Yonts, Manager Copy Service Department . . . D. C. Funk, Circulation Manager.*

REPRESENTATIVES: New England—Warren E. Hoffman, 269 S. Marshall Street, Hartford, Conn. . . . New York City—A. E. Wailes, 55 West 42nd Street, . . . Ohio,—Dudley B. Trott, 12227 Clifton Blvd., Lakewood.

Telescopic Taper Attachment

Turns and bores tapers up to 3½" per foot smoothly, easily and accurately. Telescopic feature eliminates necessity of disconnecting cross feed screw when taper attachment is in use.



16" x 8' Underneath Belt Motor Driven Tool Room Lathe

13" x 5' Underneath Belt Motor Driven Lathe

SOUTH BEND LATHES FOR REAL EFFICIENCY

In all classes of industry South Bend Lathes are meeting the need for real efficiency in precision machine work. All types of operations, from heavy roughing cuts on production work to precision finishing in tool and gauge departments can be economically performed on South Bend Lathes, because they have ample power, extreme accuracy and an unusually wide range of smooth, vibrationless spindle speeds.

SIZES AND TYPES

Manufactured in 9", 11", 13", 14½", and 16" swing. Bed lengths 3' to 12', Quick Change and Standard Change Gear types. Motor Drive and Countershaft Drive. Attachments are available for production, tool room, laboratory and general machine work.

New South Bend Lathe Catalog

Write today for a copy of our new 112-page catalog describing all sizes and types of South Bend Lathes.

SOUTH BEND LATHE WORKS
767 E. Madison Street
SOUTH BEND, INDIANA, U. S. A.

EDITOR'S PAGE

With order files bulging and a shortage of alibis for slow deliveries, visions of factory expansion are natural.

But when lean business years have followed such hurried expansions and it has been a headache to keep the full capacity profitably occupied — there's some hesitancy about again investing in plant extensions.

To some extent that summarizes the present picture in the machine tool industry.

Operating at about half capacity a year ago, the index is now up in the nineties, where it should remain for a while. Instead of rushing out and building bigger and better factories immediately, other expedients have been followed.

Some have simplified lines and cut down the number of types of machines. One company in particular increased output materially by this method.

Others have distributed manufacture of parts and assemblies, handling the final assemblies in their own shops.

In several cases, contracts for complete machines have been placed with outside companies.

Generally, the machine tool builders had already improved and modernized their own manufacturing equipment for increased production. Telling others to modernize, they have taken liberal doses of their own medicine.

There have been notable plant expansions commenced before the present splurge, such as Pratt & Whitney's fine new factory at East Hartford—Landis Tool Co., Waynesboro, Pa., — Ex-Cell-O Corp., Detroit — Jones & Lamson Machine Co.. at Springfield, Vt.,—Monarch Machine Tool Co., Sidney, Ohio and others. Kearney & Trecker Corp. is reported to be breaking ground for an addition at Milwaukee.

One of the problems has been to assure regular customers in this country that deliveries may be had within a reasonable time. Optimistic reports that the industry was booked "solid" for months ahead has tended to discourage some potential buyers. Most companies have restricted exports and are apportioning a generous share of their products for domestic trade. After the armament boom is over, it will be necessary to rely on domestic business. There is another angle—equipping Europe for war is inviting some fierce trade competition when peace finally comes.

The volume of business is down slightly from the Fall peaks, which was anticipated. General business should be active in the metal working field and with heavy purchases by the aircraft industry, the Army and the Navy, it should be a prosperous year.

The Modern Attitude . . .

Youth (and too many of the grown-ups) of today often query:—"What is the Government going to do for me"? Just a few years back the question was reversed into:—"What can I do for the Government"?

The attitude has been fostered by overmuch coddling and maneuvering for political advantage.

Nobody can object to help for those who really need it—but this country was built on a foundation of independence and self-help and it is time to give serious thought to the problem of continuing to help those who are unwilling to help themselves.

PHONE RYERSON any time . . . for any amount . . . or any kind of steel. Your order will get Immediate Action. The steel is in stock, and will be delivered promptly—where and when you need it.

When steel inventories are low, when you need unusual sizes or analyses, when non-uniform quality steel hinders production, call Ryerson. Over 10,000 sizes, shapes, and kinds of steel and allied products—from structurals to stainless, from heat treated alloys to nuts and bolts—are included in Ryerson Certified Steel products. All are closely controlled as to analysis, accuracy, finish, etc., and each represents the highest quality in that particular class and type of material.

Write for Stock List.

Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, St. Louis, Detroit, Cincinnati, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.

RYERSON CERTIFIED STEELS

RYERSON

GEAR HOBBING

Accuracy Is Essential for Quiet Gear Operation. Here are the High Points in Achieving Accuracy.

By Charles Staub, Chief Engineer,
Michigan Tool Company
Detroit, Mich.

HOW TO manufacture accurate—and therefore quiet—gears is the problem that confronts the gear manufacturer of today, (especially the transmission builder). Noisy gears are always found to be inaccurate.

There are a good many different ways by which inaccuracies can creep into gears and cause them to be noisy: For instance, steel may not be properly handled (heat treatment), machines may be inaccurate, operators may be careless, cutters or generating tools may be inaccurate.

Being more intricate than most parts, gears must be made and inspected more precisely than other simpler machine parts or automobile components. Proper inspection will save much time in the final assembly.

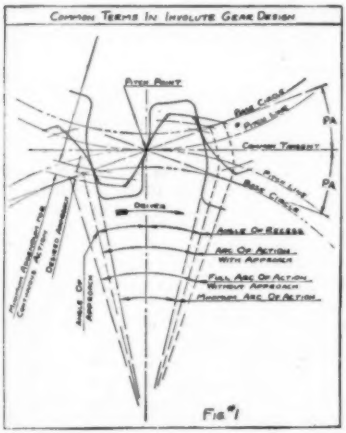


Fig. 1

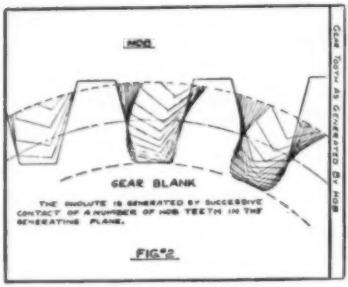
Experience has demonstrated time and again that we cannot deviate very far from the fundamental laws of gearing and still expect to get quiet gears.

In order that a pair of gears may transmit power at a constant velocity ratio, their tooth curves must be such that a normal to the common tangent of the teeth at the point of contact will always pass through the pitch point.

Fig. 1 shows a method of calculating the arc of contact of any two mating gears; also, the length of contact of the involute curve with its mating gear. In order to actually produce such gears, one of the many necessary requirements is to use accurate hobs. The best design and the best equipment will not prevent errors which originate in inaccurate hobs. In hobbing it is of paramount importance that the lead of the hob be made accurate. By this is meant not only that the thread of the hob be advanced a given amount in each and every convolution, but that the lead must not deviate more than .0005" from the true helical path of the tread in making a convolution.

If the fundamental facts are kept in mind by the manufacturer, it will help a great deal toward eliminating gear trouble.

To design and use a hob intelligently, it is necessary to understand the ge-


HOB
GEAR BLANK
THE INVOLUTE IS GENERATED BY SUCCESSIVE CONTACT OF A NUMBER OF HOB TEETH IN THE GENERATING PLANE.
GEAR TOOTH AS GENERATED BY HOB
FIG. 2

ometrical laws involved.

Generating

The increments of cuts as a hob generates a gear tooth are shown in Fig. 2. Note that the involute is generated by successive contact of a number of hob teeth in the generating plane.

End Position

To obtain greatest tool life for production cutting, it would be well to consider the number of teeth to be cut in order to determine the last point of contact that a gear tooth has with a hob tooth and the last cutting position at which a hob may be set and still obtain full generating action. Fig. 3 shows a method of calculating these contacts.

Hob Design

We have developed a number of test fixtures to control the manufacturing process of hobs based on the fundamental law of gearing. These fixtures will also be of unlimited value to the users of hobs to control the quality of tools coming into their plants.

They will indicate how closely the finished hob approaches the ideal condition and what may be expected of it in the direction of producing accurate—quiet—gears.

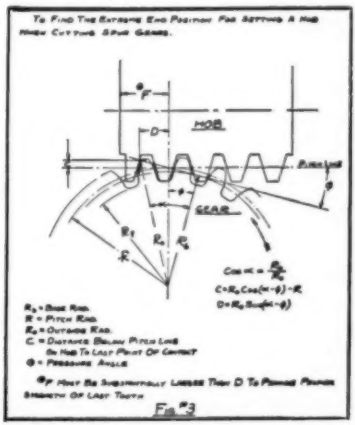
Lead Checking

Fig. 6 shows a hob on a "sine-bar" lead checking machine that can be set to check any lead from .144" to 2.6". The sine-bar method of checking eliminates the possibility of lead screw errors. Such errors at times will cover up errors in hob lead or deviations of the hob teeth from the true path of helix At other times they will tend to exaggerate such hob errors. Another good feature of this type of machine is that it eliminates the necessity of having a master lead screw for every different hob pitch.

Operation of Lead Checker

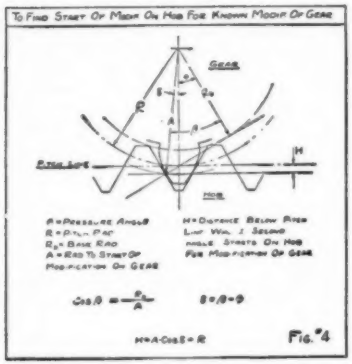
The Indicator arrangement on this lead-checker (see Fig. 6) has a 5 to 1 ratio, and will, therefore, register ten thousandths of an inch.

In operation, the contact point of the indicator is brought against the cutting edge of the hob tooth and the indicator dial is set at zero. As the table of the machine is advanced, the


To Find The Extreme End Position For Setting A Hob When Cutting Spur Gears.
HOB
GEAR
R_b = Base Rad.
R = Pitch Rad.
R_o = Outside Rad.
C = Distance Below Pitch Line On Hob To Last Point Of Contact
ϕ = Pressure Angle
D Must Be Substantially Larger Than D To Provide Proper Strength Of Last Tooth
FIG. 3

hob will start to rotate, and the slide carrying the indicator arrangement will move transversely away from the table. The amount of movement of the slide in one convolution of the hob is controlled by the setting of the sine-bar, and is equal to the lead of the hob being checked. This setting is determined by the helix angle of the hob, and is positive.

If the hob has been made correctly, the indicator point will register zero on all cutting edges. If there is a deviation of the hob teeth from the true helical path due to grinding; or


To Find Start Of Mesh On Hob For Known Mesh Of Gear
Gear
Pitch Line
Hob
A = Pressure Angle
B = Pitch Dia.
R_b = Base Rad.
A = Rad. To Start Of Modification On Gear
H = Distance Below Pitch Line Where I Begins Middle Starts On Hob For Modification Of Gear
$\cos\beta = \frac{R_b}{A}$
$\beta = \beta - \phi$
$H = A - \cos\beta = R$
Fig. 4

if the hole in the hob is larger and does not fit the arbor; or if the gashes in the hob are not properly spaced, the indicator will register a great variation in the cutting edges as they pass by the indicating points.

Modifications

The involute gear as it is made today, especially in the automobile field, has a modified involute tooth form and hobs have to be designed to form these modifications, (or approach curves, as they are sometimes called) without breaking the arc of contact with the mating gears. Fig. 4 is a formula showing how to find the start of modification on the gear. In modifying gear teeth, care must be taken not to modify them excessively, since modification

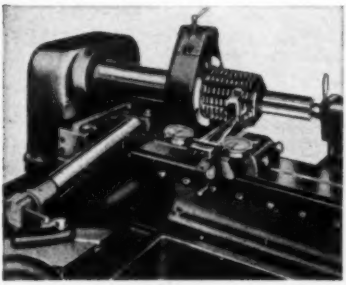


Fig. 6—Checking a hob on a sine-bar lead checking machine.

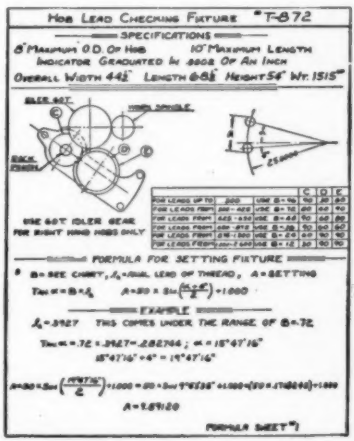
of the involute form reduces the amount of involute over-lap, and therefore the number of teeth in contact.

After making these calculations, a hob must then be made that will correctly generate the modified involute. The contour must be correct on all of its cutting teeth. All of its cutting teeth must follow the true helical path and all of its cutting edges must be concentric.

To check hobs for these fundamental requirements, it is essential to have accurate checking equipment designed for the purpose.

Hob Contour Checking

Fig. 8 shows a hob on a contour testing fixture, the indicator arrangement


Hob Lead Checking Fixture "T-872
Specifications
6" Maximum O.D. Of Hob 10" Maximum Length
Indicator Graduated In .0002 Or An Inch
Overall Width 44½" Length 68½" Height 54" Wt. 1515#
Back Center
Work Spindle
Use 60° Idler Gear For Right Hand Hobs Only
Formula For Setting Fixture
Example

of which is designed so that a movement of .0002" on the point of contact will register .0001" on the dial indicator. By this amplification it is possible to check the contour of hob teeth to ten thousandths of an inch.

The instrument has a knife edge and is sensitive enough to actually register such depressions and elevations as are caused by rough grinding. It will also show any deviation from the true pressure angle. Use of a sine-bar setting eliminates the necessity of having a number of interchangeable angle

blocks for the different pressure angles.

Typical lead inspection chart of gear hob.

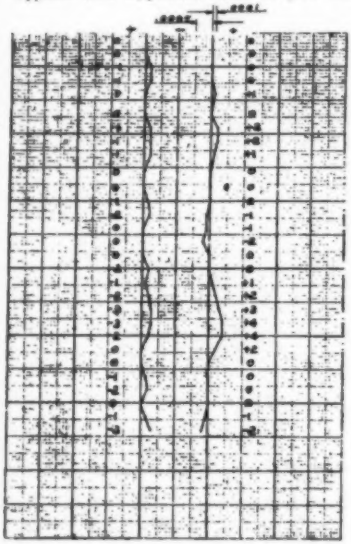


Fig. 7—Lead chart showing how lead of hob can be plotted graphically to show just where and how great the errors are.

Eliminating "Flats"

Use of hob centering gages is supposedly to insure gear teeth being symmetrical or "balanced." The theory is that centralizing either a hob tooth or space with the common center line between hob and blank will cause the series of flats comprising the tooth forms to be theoretically equalized on each side. In good hobbing practice, these flats, caused by the successive hob teeth generating the involutes, are so close together, however, that they merge into smooth curves. Usually they cannot be detected by the most sensitive profile measuring devices, and cannot ordinarily be seen when a gear is rolled with its mate to observe the bearing.

When visible flats do appear on hobbed work, the remedy is not to resort to centralizing gages, as is commonly supposed. Such a procedure may occasionally result in better balanced forms, but will not eliminate the flats. This practice is carried over from the time when most gear teeth were produced by milling with disc cutters, the latter requiring accurate centralization to obtain balanced forms.

It is far better to eliminate the cause of such visible flats. Their presence is commonly caused by the combination of too few a number of gashes in the hob, with too low a number of teeth in the blank, particularly in the coarse pitches. The obvious remedy is to increase the number of gashes in the hob.

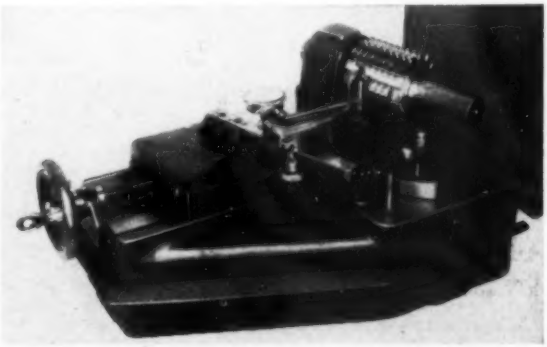


Fig. 8—Hob contour checking fixture with indicator arrangement capable of checking contour to ten-thousandths.

TESTED QUALITY

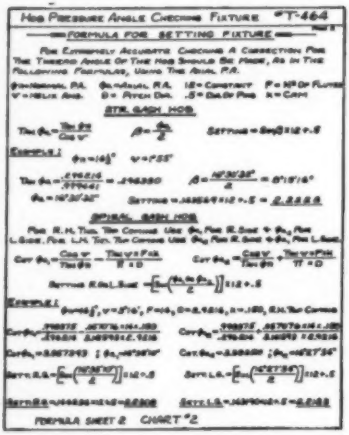
. . . BUILT TO THE SAME QUALITY STANDARDS AS MILWAUKEE MILLING MACHINES

THE same standards which have won for the Kearney & Trecker Corporation world-wide recognition for quality milling machines are applied in the manufacture of K & T Arbors. There is a difference in arbors.

KEARNEY & TRECKER CORPORATION
Milwaukee, Wisconsin

PROFIT MORE WITH K&T PRODUCTS

K&T *Milwaukee* MILLING MACHINES


HOB PRESSURE ANGLE CHECKING FIXTURE "T-464"

FORMULA FOR SETTING FIXTURE

FOR EXTREMELY ACCURATE CHECKING A CORRECTION FOR THE TANGENT ANGLE OF THE HOB SHOULD BE MADE, AS IN THE FOLLOWING FORMULAS, USING THE AXIAL P.A.

ϕ_n=NORMAL P.A. ϕ_a=AXIAL P.A. 12=CONSTANT P=NO. OF FLUTES
V=HELIX ANG. D=PITCH DIA. .5=DIA. OF PIN X=CORR.

STR. GASH HOB

$\tan \phi_a = \frac{\tan \phi_n}{\cos V}$ $\beta = \frac{\phi_a}{2}$ SETTING = $\sin \beta \times 12 + .5$

EXAMPLE 1

$\phi_n = 14\frac{1}{2}°$ $V = 7°55'$

$\tan \phi_a = \frac{.256516}{.990041} = .2590350$ $\beta = \frac{14°39'24''}{2} = 7°19'42''$

$\phi_a = 14°39'24''$ SETTING = $.1265449 \times 12 + .5 = 2.2258$

SPIRAL GASH HOB

FOR R.H. TOOL, THE CORRECTION USED ϕ_a FOR R. SIDE + ϕ_a FOR L. SIDE. FOR L.H. TOOL, THE CORRECTION USED ϕ_a FOR R. SIDE ϕ_a FOR L. SIDE.

$\cot \phi_a = \frac{\cos V}{\tan \phi_n} - \frac{\tan V \times P \times X}{D \times \pi}$ $\cot \phi_a = \frac{\cos V}{\tan \phi_n} - \frac{\tan V \times P \times X}{D \times \pi}$

SETTING R.H. L. SIDE $= \frac{1}{\sin}\left[\frac{(\phi_a \text{ R.H.} + \phi_a \text{ L.H.})}{2}\right] \times 12 + .5$

EXAMPLE 2

$\phi_n = 20\frac{1}{2}°$, $V = 5°16'$, $P = 16$, $D = 8.4616$, $X = .150$, R.H. TOOL CORRECTION

$\cot \phi_a = \frac{.990575 - .087078 \times .150}{.996264 - .049393 \times 2.9234}$ $\cot \phi_a = \frac{.990575 + .087078 \times .150}{.996264 + .049393 \times 2.9234}$

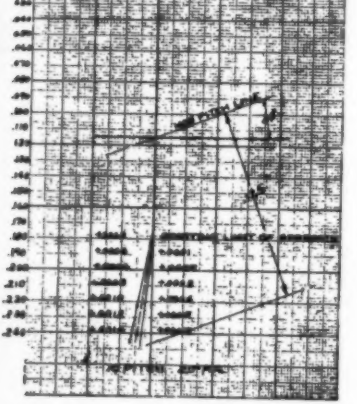
$\cot \phi_a = 3.0673913$ $\phi_a = 18°24'56''$ $\cot \phi_a = 2.550630$ $\phi_a = 21°27'56''$

SETTING R.H. $= \frac{1}{\sin}\left[\frac{(18°24'56'')}{2}\right] \times 12 + .5$ SETTING L.H. $= \frac{1}{\sin}\left[\frac{(21°27'56'')}{2}\right] \times 12 + .5$

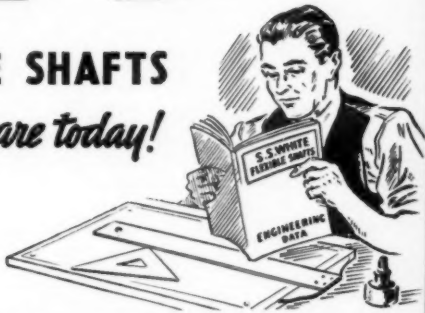
SETTING R.H. $= 1.4958 \times 12 + .5 = 18.4996$ SETTING L.H. $= 1.6578 \times 12 + .5 = 20.4936$

FORMULA SHEET 2 CHART #2

Formula sheet No. 2—Charts No. 1 and 2 show settings for hobs of various pressure angles on straight gashed hobs, and a method of figuring correction in pressure angles for both straight and spiral gashed hobs for extreme accuracy.


MASTER FORM
LIMIT OF MODIFICATION
.0005
.0010
.0015
.0020
.0025
.0030
.0035
.0040
.0045
.0050
.0055
.0060
.0065
.0070
.0075
.0080
.0085
.0090
.0095
.0100
.0105
.0110
.0115
.0120
.0125
.0130
.0135
.0140
.0145
.0150
.0155
.0160
.0165
.0170
.0175
.0180
.0185
.0190
.0195
.0200
.0205
.0210
.0215
.0220
.0225
.0230
.0235
.0240
.0245
.0250
.0255
.0260
.0265
.0270
.0275
.0280
.0285
.0290
.0295
.0300
.0305
.0310
.0315
.0320
.0325
.0330
.0335
.0340
.0345
.0350
.0355
.0360
.0365
.0370
.0375
.0380
.0385
.0390
.0395
.0400
.0405
.0410
.0415
.0420
.0425
.0430
.0435
.0440
.0445
.0450
.0455
.0460
.0465
.0470
.0475
.0480
.0485
.0490
.0495
.0500
.0505
.0510
.0515
.0520
.0525
.0530
.0535
.0540
.0545
.0550
.0555
.0560
.0565
.0570
.0575
.0580
.0585
.0590
.0595
.0600
.0605
.0610
.0615
.0620
.0625
.0630
.0635
.0640
.0645
.0650
.0655
.0660
.0665
.0670
.0675
.0680
.0685
.0690
.0695
.0700
.0705
.0710
.0715
.0720
.0725
.0730
.0735
.0740
.0745
.0750
.0755
.0760
.0765
.0770
.0775
.0780
.0785
.0790
.0795
.0800
.0805
.0810
.0815
.0820
.0825
.0830
.0835
.0840
.0845
.0850
.0855
.0860
.0865
.0870
.0875
.0880
.0885
.0890
.0895
.0900
.0905
.0910
.0915
.0920
.0925
.0930
.0935
.0940
.0945
.0950
.0955
.0960
.0965
.0970
.0975
.0980
.0985
.0990
.0995
.1000
.1005
.1010
.1015
.1020
.1025
.1030
.1035
.1040
.1045
.1050
.1055
.1060
.1065
.1070
.1075
.1080
.1085
.1090
.1095
.1100
.1105
.1110
.1115
.1120
.1125
.1130
.1135
.1140
.1145
.1150
.1155
.1160
.1165
.1170
.1175
.1180
.1185
.1190
.1195
.1200
.1205
.1210
.1215
.1220
.1225
.1230
.1235
.1240
.1245
.1250
.1255
.1260
.1265
.1270
.1275
.1280
.1285
.1290
.1295
.1300
.1305
.1310
.1315
.1320
.1325
.1330
.1335
.1340
.1345
.1350
.1355
.1360
.1365
.1370
.1375
.1380
.1385
.1390
.1395
.1400
.1405
.1410
.1415
.1420
.1425
.1430
.1435
.1440
.1445
.1450
.1455
.1460
.1465
.1470
.1475
.1480
.1485
.1490
.1495
.1500
.1505
.1510
.1515
.1520
.1525
.1530
.1535
.1540
.1545
.1550
.1555
.1560
.1565
.1570
.1575
.1580
.1585
.1590
.1595
.1600
.1605
.1610
.1615
.1620
.1625
.1630
.1635
.1640
.1645
.1650
.1655
.1660
.1665
.1670
.1675
.1680
.1685
.1690
.1695
.1700
.1705
.1710
.1715
.1720
.1725
.1730
.1735
.1740
.1745
.1750
.1755
.1760
.1765
.1770
.1775
.1780
.1785
.1790
.1795
.1800
.1805
.1810
.1815
.1820
.1825
.1830
.1835
.1840
.1845
.1850
.1855
.1860
.1865
.1870
.1875
.1880
.1885
.1890
.1895
.1900
.1905
.1910
.1915
.1920
.1925
.1930
.1935
.1940
.1945
.1950
.1955
.1960
.1965
.1970
.1975
.1980
.1985
.1990
.1995
.2000
.2005
.2010
.2015
.2020
.2025
.2030
.2035
.2040
.2045
.2050
.2055
.2060
.2065
.2070
.2075
.2080
.2085
.2090
.2095
.2100
.2105
.2110
.2115
.2120
.2125
.2130
.2135
.2140
.2145
.2150
.2155
.2160
.2165
.2170
.2175
.2180
.2185
.2190
.2195
.2200
.2205
.2210
.2215
.2220
.2225
.2230
.2235
.2240
.2245
.2250
.2255
.2260
.2265
.2270
.2275
.2280
.2285
.2290
.2295
.2300
.2305
.2310
.2315
.2320
.2325
.2330
.2335
.2340
.2345
.2350
.2355
.2360
.2365
.2370
.2375
.2380
.2385
.2390
.2395
.2400
.2405
.2410
.2415
.2420
.2425
.2430
.2435
.2440
.2445
.2450
.2455
.2460
.2465
.2470
.2475
.2480
.2485
.2490
.2495
.2500
.2505
.2510
.2515
.2520
.2525
.2530
.2535
.2540
.2545
.2550
.2555
.2560
.2565
.2570
.2575
.2580
.2585
.2590
.2595
.2600
.2605
.2610
.2615
.2620
.2625
.2630
.2635
.2640
.2645
.2650
.2655
.2660
.2665
.2670
.2675
.2680
.2685
.2690
.2695
.2700
.2705
.2710
.2715
.2720
.2725
.2730
.2735
.2740
.2745
.2750
.2755
.2760
.2765
.2770
.2775
.2780
.2785
.2790
.2795
.2800
.2805
.2810
.2815
.2820
.2825
.2830
.2835
.2840
.2845
.2850
.2855
.2860
.2865
.2870
.2875
.2880
.2885
.2890
.2895
.2900
.2905
.2910
.2915
.2920
.2925
.2930
.2935
.2940
.2945
.2950
.2955
.2960
.2965
.2970
.2975
.2980
.2985
.2990
.2995
.3000
.3005
.3010
.3015
.3020
.3025
.3030
.3035
.3040
.3045
.3050
.3055
.3060
.3065
.3070
.3075
.3080
.3085
.3090
.3095
.3100
.3105
.3110
.3115
.3120
.3125
.3130
.3135
.3140
.3145
.3150
.3155
.3160
.3165
.3170
.3175
.3180
.3185
.3190
.3195
.3200
.3205
.3210
.3215
.3220
.3225
.3230
.3235
.3240
.3245
.3250
.3255
.3260
.3265
.3270
.3275
.3280
.3285
.3290
.3295
.3300
.3305
.3310
.3315
.3320
.3325
.3330
.3335
.3340
.3345
.3350
.3355
.3360
.3365
.3370
.3375
.3380
.3385
.3390
.3395
.3400
.3405
.3410
.3415
.3420
.3425
.3430
.3435
.3440
.3445
.3450
.3455
.3460
.3465
.3470
.3475
.3480
.3485
.3490
.3495
.3500
.3505
.3510
.3515
.3520
.3525
.3530
.3535
.3540
.3545
.3550
.3555
.3560
.3565
.3570
.3575
.3580
.3585
.3590
.3595
.3600
.3605
.3610
.3615
.3620
.3625
.3630
.3635
.3640
.3645
.3650
.3655
.3660
.3665
.3670
.3675
.3680
.3685
.3690
.3695
.3700
.3705
.3710
.3715
.3720
.3725
.3730
.3735
.3740
.3745
.3750
.3755
.3760
.3765
.3770
.3775
.3780
.3785
.3790
.3795
.3800
.3805
.3810
.3815
.3820
.3825
.3830
.3835
.3840
.3845
.3850
.3855
.3860
.3865
.3870
.3875
.3880
.3885
.3890
.3895
.3900
.3905
.3910
.3915
.3920
.3925
.3930
.3935
.3940
.3945
.3950
.3955
.3960
.3965
.3970
.3975
.3980
.3985
.3990
.3995
.4000
.4005
.4010
.4015
.4020
.4025
.4030
.4035
.4040
.4045
.4050
.4055
.4060
.4065
.4070
.4075
.4080
.4085
.4090
.4095
.4100
.4105
.4110
.4115
.4120
.4125
.4130
.4135
.4140
.4145
.4150
.4155
.4160
.4165
.4170
.4175
.4180
.4185
.4190
.4195
.4200
.4205
.4210
.4215
.4220
.4225
.4230
.4235
.4240
.4245
.4250
.4255
.4260
.4265
.4270
.4275
.4280
.4285
.4290
.4295
.4300
.4305
.4310
.4315
.4320
.4325
.4330
.4335
.4340
.4345
.4350
.4355
.4360
.4365
.4370
.4375
.4380
.4385
.4390
.4395
.4400
.4405
.4410
.4415
.4420
.4425
.4430
.4435
.4440
.4445
.4450
.4455
.4460
.4465
.4470
.4475
.4480
.4485
.4490
.4495
.4500
.4505
.4510
.4515
.4520
.4525
.4530
.4535
.4540
.4545
.4550
.4555
.4560
.4565
.4570
.4575
.4580
.4585
.4590
.4595
.4600
.4605
.4610
.4615
.4620
.4625
.4630
.4635
.4640
.4645
.4650
.4655
.4660
.4665
.4670
.4675
.4680
.4685
.4690
.4695
.4700
.4705
.4710
.4715
.4720
.4725
.4730
.4735
.4740
.4745
.4750
.4755
.4760
.4765
.4770
.4775
.4780
.4785
.4790
.4795
.4800
.4805
.4810
.4815
.4820
.4825
.4830
.4835
.4840
.4845
.4850
.4855
.4860
.4865
.4870
.4875
.4880
.4885
.4890
.4895
.4900
.4905
.4910
.4915
.4920
.4925
.4930
.4935
.4940
.4945
.4950
.4955
.4960
.4965
.4970
.4975
.4980
.4985
.4990
.4995
.5000
.5005
.5010
.5015
.5020
.5025
.5030
.5035
.5040
.5045
.5050
.5055
.5060
.5065
.5070
.5075
.5080
.5085
.5090
.5095
.5100
.5105
.5110
.5115
.5120
.5125
.5130
.5135
.5140
.5145
.5150
.5155
.5160
.5165
.5170
.5175
.5180
.5185
.5190
.5195
.5200
.5205
.5210
.5215
.5220
.5225
.5230
.5235
.5240
.5245
.5250
.5255
.5260
.5265
.5270
.5275
.5280
.5285
.5290
.5295
.5300
.5305
.5310
.5315
.5320
.5325
.5330
.5335
.5340
.5345
.5350
.5355
.5360
.5365
.5370
.5375
.5380
.5385
.5390
.5395
.5400
.5405
.5410
.5415
.5420
.5425
.5430
.5435
.5440
.5445
.5450
.5455
.5460
.5465
.5470
.5475
.5480
.5485
.5490
.5495
.5500
.5505
.5510
.5515
.5520
.5525
.5530
.5535
.5540
.5545
.5550
.5555
.5560
.5565
.5570
.5575
.5580
.5585
.5590
.5595
.5600
.5605
.5610
.5615
.5620
.5625
.5630
.5635
.5640
.5645
.5650
.5655
.5660
.5665
.5670
.5675
.5680
.5685
.5690
.5695
.5700
.5705
.5710
.5715
.5720
.5725
.5730
.5735
.5740
.5745
.5750
.5755
.5760
.5765
.5770
.5775
.5780
.5785
.5790
.5795
.5800
.5805
.5810
.5815
.5820
.5825
.5830
.5835
.5840
.5845
.5850
.5855
.5860
.5865
.5870
.5875
.5880
.5885
.5890
.5895
.5900
.5905
.5910
.5915
.5920
.5925
.5930
.5935
.5940
.5945
.5950
.5955
.5960
.5965
.5970
.5975
.5980
.5985
.5990
.5995
.6000
.6005
.6010
.6015
.6020
.6025
.6030
.6035
.6040
.6045
.6050
.6055
.6060
.6065
.6070
.6075
.6080
.6085
.6090
.6095
.6100
.6105
.6110
.6115
.6120
.6125
.6130
.6135
.6140
.6145
.6150
.6155
.6160
.6165
.6170
.6175
.6180
.6185
.6190
.6195
.6200
.6205
.6210
.6215
.6220
.6225
.6230
.6235
.6240
.6245
.6250
.6255
.6260
.6265
.6270
.6275
.6280
.6285
.6290
.6295
.6300
.6305
.6310
.6315
.6320
.6325
.6330
.6335
.6340
.6345
.6350
.6355
.6360
.6365
.6370
.6375
.6380
.6385
.6390
.6395
.6400
.6405
.6410
.6415
.6420
.6425
.6430
.6435
.6440
.6445
.6450
.6455
.6460
.6465
.6470
.6475
.6480
.6485
.6490
.6495
.6500
.6505
.6510
.6515
.6520
.6525
.6530
.6535
.6540
.6545
.6550
.6555
.6560
.6565
.6570
.6575
.6580
.6585
.6590
.6595
.6600
.6605
.6610
.6615
.6620
.6625
.6630
.6635
.6640
.6645
.6650
.6655
.6660
.6665
.6670
.6675
.6680
.6685
.6690
.6695
.6700
.6705
.6710
.6715
.6720
.6725
.6730
.6735
.6740
.6745
.6750
.6755
.6760
.6765
.6770
.6775
.6780
.6785
.6790
.6795
.6800
.6805
.6810
.6815
.6820
.6825
.6830
.6835
.6840
.6845
.6850
.6855
.6860
.6865
.6870
.6875
.6880
.6885
.6890
.6895
.6900
.6905
.6910
.6915
.6920
.6925
.6930
.6935
.6940
.6945
.6950
.6955
.6960
.6965
.6970
.6975
.6980
.6985
.6990
.6995
.7000
.7005
.7010
.7015
.7020
.7025
.7030
.7035
.7040
.7045
.7050
.7055
.7060
.7065
.7070
.7075
.7080
.7085
.7090
.7095
.7100
.7105
.7110
.7115
.7120
.7125
.7130
.7135
.7140
.7145
.7150
.7155
.7160
.7165
.7170
.7175
.7180
.7185
.7190
.7195
.7200
.7205
.7210
.7215
.7220
.7225
.7230
.7235
.7240
.7245
.7250
.7255
.7260
.7265
.7270
.7275
.7280
.7285
.7290
.7295
.7300
.7305
.7310
.7315
.7320
.7325
.7330
.7335
.7340
.7345
.7350
.7355
.7360
.7365
.7370
.7375
.7380
.7385
.7390
.7395
.7400
.7405
.7410
.7415
.7420
.7425
.7430
.7435
.7440
.7445
.7450
.7455
.7460
.7465
.7470
.7475
.7480
.7485
.7490
.7495
.7500
.7505
.7510
.7515
.7520
.7525
.7530
.7535
.7540
.7545
.7550
.7555
.7560
.7565
.7570
.7575
.7580
.7585
.7590
.7595
.7600
.7605
.7610
.7615
.7620
.7625
.7630
.7635
.7640
.7645
.7650
.7655
.7660
.7665
.7670
.7675
.7680
.7685
.7690
.7695
.7700
.7705
.7710
.7715
.7720
.7725
.7730
.7735
.7740
.7745
.7750
.7755
.7760
.7765
.7770
.7775
.7780
.7785
.7790
.7795
.7800
.7805
.7810
.7815
.7820
.7825
.7830
.7835
.7840
.7845
.7850
.7855
.7860
.7865
.7870
.7875
.7880
.7885
.7890
.7895
.7900
.7905
.7910
.7915
.7920
.7925
.7930
.7935
.7940
.7945
.7950
.7955
.7960
.7965
.7970
.7975
.7980
.7985
.7990
.7995
.8000
.8005
.8010
.8015
.8020
.8025
.8030
.8035
.8040
.8045
.8050
.8055
.8060
.8065
.8070
.8075
.8080
.8085
.8090
.8095
.8100
.8105
.8110
.8115
.8120
.8125
.8130
.8135
.8140
.8145
.8150
.8155
.8160
.8165
.8170
.8175
.8180
.8185
.8190
.8195
.8200
.8205
.8210
.8215
.8220
.8225
.8230
.8235
.8240
.8245
.8250
.8255
.8260
.8265
.8270
.8275
.8280
.8285
.8290
.8295
.8300
.8305
.8310
.8315
.8320
.8325
.8330
.8335
.8340
.8345
.8350
.8355
.8360
.8365
.8370
.8375
.8380
.8385
.8390
.8395
.8400
.8405
.8410
.8415
.8420
.8425
.8430
.8435
.8440
.8445
.8450
.8455
.8460
.8465
.8470
.8475
.8480
.8485
.8490
.8495
.8500
.8505
.8510
.8515
.8520
.8525
.8530
.8535
.8540
.8545
.8550
.8555
.8560
.8565
.8570
.8575
.8580
.8585
.8590
.8595
.8600
.8605
.8610
.8615
.8620
.8625
.8630
.8635
.8640
.8645
.8650
.8655
.8660
.8665
.8670
.8675
.8680
.8685
.8690
.8695
.8700
.8705
.8710
.8715
.8720
.8725
.8730
.8735
.8740
.8745
.8750
.8755
.8760
.8765
.8770
.8775
.8780
.8785
.8790
.8795
.8800
.8805
.8810
.8815
.8820
.8825
.8830
.8835
.8840
.8845
.8850
.8855
.8860
.8865
.8870
.8875
.8880
.8885
.8890
.8895
.8900
.8905
.8910
.8915
.8920
.8925
.8930
.8935
.8940
.8945
.8950
.8955
.8960
.8965
.8970
.8975
.8980
.8985
.8990
.8995
.9000
.9005
.9010
.9015
.9020
.9025
.9030
.9035
.9040
.9045
.9050
.9055
.9060
.9065
.9070
.9075
.9080
.9085
.9090
.9095
.9100
.9105
.9110
.9115
.9120
.9125
.9130
.9135
.9140
.9145
.9150
.9155
.9160
.9165
.9170
.9175
.9180
.9185
.9190
.9195
.9200
.9205
.9210
.9215
.9220
.9225
.9230
.9235
.9240
.9245
.9250
.9255
.9260
.9265
.9270
.9275
.9280
.9285
.9290
.9295
.9300
.9305
.9310
.9315
.9320
.9325
.9330
.9335
.9340
.9345
.9350
.9355
.9360
.9365
.9370
.9375
.9380
.9385
.9390
.9395
.9400
.9405
.9410
.9415
.9420
.9425
.9430
.9435
.9440
.9445
.9450
.9455
.9460
.9465
.9470
.9475
.9480
.9485
.9490
.9495
.9500
.9505
.9510
.9515
.9520
.9525
.9530
.9535
.9540
.9545
.9550
.9555
.9560
.9565
.9570
.9575
.9580
.9585
.9590
.9595
.9600
.9605
.9610
.9615
.9620
.9625
.9630
.9635
.9640
.9645
.9650
.9655
.9660
.9665
.9670
.9675
.9680
.9685
.9690
.9695
.9700
.9705
.9710
.9715
.9720
.9725
.9730
.9735
.9740
.9745
.9750
.9755
.9760
.9765
.9770
.9775
.9780
.9785
.9790
.9795
.9800
.9805
.9810
.9815
.9820
.9825
.9830
.9835
.9840
.9845
.9850
.9855
.9860
.9865
.9870
.9875
.9880
.9885
.9890
.9895
.9900
.9905
.9910
.9915
.9920
.9925
.9930
.9935
.9940
.9945
.9950
.9955
.9960
.9965
.9970
.9975
.9980
.9985
.9990
.9995
1.0000
1.0005
1.0010
1.0015
1.0020
1.0025
1.0030
1.0035
1.0040
1.0045
1.0050
1.0055
1.0060
1.0065
1.0070
1.0075
1.0080
1.0085
1.0090
1.0095
1.0100
1.0105
1.0110
1.0115
1.0120
1.0125
1.0130
1.0135
1.0140
1.0145
1.0150
1.0155
1.0160
1.0165
1.0170
1.0175
1.0180
1.0185
1.0190
1.0195
1.0200
1.0205
1.0210
1.0215
1.0220
1.0225
1.0230
1.0235
1.0240
1.0245
1.0250
1.0255
1.0260
1.0265
1.0270
1.0275
1.0280
1.0285
1.0290
1.0295
1.0300
1.0305
1.0310
1.0315
1.0320
1.0325
1.0330
1.0335
1.0340
1.0345
1.0350
1.0355
1.0360
1.0365
1.0370
1.0375
1.0380
1.0385
1.0390
1.0395
1.0400
1.0405
1.0410
1.0415
1.0420
1.0425
1.0430
1.0435
1.0440
1.0445
1.0450
1.0455
1.0460
1.0465
1.0470
1.0475
1.0480
1.0485
1.0490
1.0495
1.0500
1.0505
1.0510
1.0515
1.0520
1.0525
1.0530
1.0535
1.0540
1.0545
1.0550
1.0555
1.0560
1.0565
1.0570
1.0575
1.0580
1.0585
1.0590
1.0595
1.0600
1.0605
1.0610
1.0615
1.0620
1.0625
1.0630
1.0635
1.0640
1.0645
1.0650
1.0655
1.0660
1.0665
1.0670
1.0675
1.0680
1.0685
1.0690
1.0695
1.0700
1.0705
1.0710
1.0715
1.0720
1.0725
1.0730
1.0735
1.0740
1.0745
1.0750
1.0755
1.0760
1.0765
1.0770
1.0775
1.0780
1.0785
1.0790
1.0795
1.0800
1.0805
1.0810
1.0815
1.0820
1.0825
1.0830
1.0835
1.0840
1.0845
1.0850
1.0855
1.0860
1.0865
1.0870
1.0875
1.0880
1.0885
1.0890
1.0895
1.0900
1.0905
1.0910
1.0915
1.0920
1.0925
1.0930
1.0935
1.0940
1.0945
1.0950
1.0955
1.0960
1.0965
1.0970
1.0975
1.0980
1.0985
1.0990
1.0995
1.1000
1.1005
1.1010
1.1015
1.1020
1.1025
1.1030
1.1035
1.1040
1.1045
1.1050
1.1055
1.1060
1.1065
1.1070
1.1075
1.1080
1.1085
1.1090
1.1095
1.1100
1.1105
1.1110
1.1115
1.1120
1.1125
1.1130
1.1135
1.1140
1.1145
1.1150
1.1155
1.1160
1.1165
1.1170
1.1175
1.1180
1.1185
1.1190
1.1195
1.1200
1.1205
1.1210
1.1215
1.1220
1.1225
1.1230
1.1235
1.1240
1.1245
1.1250
1.1255
1.1260
1.1265
1.1270
1.1275
1.1280
1.1285
1.1290
1.1295
1.1300
1.1305
1.1310
1.1315
1.1320
1.1325
1.1330
1.1335
1.1340
1.1345
1.1350
1.1355
1.1360
1.1365
1.1370
1.1375
1.1380
1.1385
1.1390
1.1395
1.1400
1.1405
1.1410
1.1415
1.1420
1.1425
1.1430
1.1435
1.1440
1.1445
1.1450
1.1455
1.1460
1.1465
1.1470
1.1475
1.1480
1.1485
1.1490
1.1495
1.1500
1.1505
1.1510
1.1515
1.1520
1.1525
1.1530
1.1535
1.1540
1.1545
1.1550
1.1555
1.1560
1.1565
1.1570
1.1575
1.1580
1.1585
1.1590
1.1595
1.1600
1.1605
1.1610
1.1615
1.1620
1.1625
1.1630
1.1635
1.1640
1.1645
1.1650
1.1655
1.1660
1.1665
1.1670
1.1675
1.1680
1.1685
1.1690
1.1695
1.1700
1.1705
1.1710
1.1715
1.1720
1.1725
1.1730
1.1735
1.1740
1.1745
1.1750
1.1755
1.1760
1.1765
1.1770
1.1775
1.1780
1.1785
1.1790
1.1795
1.1800
1.1805
1.1810
1.1815
1.1820
1.1825
1.1830
1.1835
1.1840
1.1845
1.1850
1.1855
1.1860
1.1865
1.1870
1.1875
1.1880
1.1885
1.1890
1.1895
1.1900
1.1905
1.1910
1.1915
1.1920
1.1925
1.1930
1.1935
1.1940
1.1945
1.1950
1.1955
1.1960
1.1965
1.1970
1.1975
1.1980
1.1985
1.1990
1.1995
1.2000
1.2005
1.2010
1.2015
1.2020
1.2025
1.2030
1.2035
1.2040
1.2045
1.2050
1.2055
1.2060
1.2065
1.2070
1.2075
1.2080
1.2085
1.2090
1.2095
1.2100
1.2105
1.2110
1.2115
1.2120
1.2125
1.2130
1.2135
1.2140
1.2145
1.2150
1.2155
1.2160
1.2165
1.2170
1.2175
1.2180
1.2185
1.2190
1.2195
1.2200
1.2205
1.2210
1.2215
1.2220
1.2225
1.2230
1.2235
1.2240
1.2245
1.2250
1.2255
1.2260
1.2265
1.2270
1.2275
1.2280
1.2285
1.2290
1.2295
1.2300
1.2305
1.2310
1.2315
1.2320
1.2325
1.2330
1.2335
1.2340
1.2345
1.2350
1.2355
1.2360
1.2365
1.2370
1.2375
1.2380
1.2385
1.2390
1.2395
1.2400
1.2405
1.2410
1.2415
1.2420
1.2425
1.2430
1.2435
1.2440
1.2445
1.2450
1.2455
1.2460
1.2465
1.2470
1.2475
1.2480
1.2485
1.2490
1.2495
1.2500
1.2505
1.2510
1.2515
1.2520
1.2525
1.2530
1.2535
1.2540
1.2545
1.2550
1.2555
1.2560
1.2565
1.2570
1.2575
1.2580
1.2585
1.2590
1.2595
1.2600
1.2605
1.2610
1.2615
1.2620
1.2625
1.2630
1.2635
1.2640
1.2645
1.2650
1.2655
1.2660
1.2665
1.2670
1.2675
1.2680
1.2685
1.2690
1.2695
1.2700
1.2705
1.2710
1.2715
1.2720
1.2725
1.2730
1.2735
1.2740
1.2745
1.2750
1.2755
1.2760
1.2765
1.2770
1.2775
1.2780
1.2785
1.2790
1.2795
1.2800
1.2805
1.2810
1.2815
1.2820
1.2825
1.2830
1.2835
1.2840
1.2845
1.2850
1.2855
1.2860
1.2865
1.2870
1.2875
1.2880
1.2885
1.2890
1.2895
1.2900
1.2905
1.2910
1.2915
1.2920
1.2925
1.2930
1.2935
1.2940
1.2945
1.2950
1.2955
1.2960
1.2965
1.2970
1.2975
1.2980
1.2985
1.2990
1.2995
1.3000
1.3005
1.3010
1.3015
1.3020
1.3025
1.3030
1.3035
1.3040
1.3045
1.3050
1.3055
1.3060
1.3065
1.3070
1.3075
1.3080
1.3085
1.3090
1.3095
1.3100
1.3105
1.3110
1.3115
1.3120
1.3125
1.3130
1.3135
1.3140
1.3145
1.3150
1.3155
1.3160
1.3165
1.3170
1.3175
1.3180
1.3185
1.3190
1.3195
1.3200
1.3205
1.3210
1.3215
1.3220
1.3225
1.3230
1.3235
1.3240
1.3245
1.3250
1.3255
1.3260
1.3265
1.3270
1.3275
1.3280
1.3285
1.3290
1.3295
1.3300
1.3305
1.3310
1.3315
1.3320
1.3325
1.3330
1.3335
1.3340
1.3345
1.3350
1.3355
1.3360
1.3365
1.3370
1.3375
1.3380
1.3385
1.3390
1.3395
1.3400
1.3405
1.3410
1.3415
1.3420
1.3425
1.3430
1.3435
1.3440
1.3445
1.3450
1.3455
1.3460
1.3465
1.3470
1.3475
1.3480
1.3485
1.3490
1.3495
1.3500
1.3505
1.3510
1.3515
1.3520
1.3525
1.3530
1.3535
1.3540
1.3545
1.3550
1.3555
1.3560
1.3565
1.3570
1.3575
1.3580
1.3585
1.3590
1.3595
1.3600
1.3605
1.3610
1.3615
1.3620
1.3625
1.3630
1.3635
1.3640
1.3645
1.3650
1.3655
1.3660
1.3665
1.3670
1.3675
1.3680
1.3685
1.3690
1.3695
1.3700
1.3705
1.3710
1.3715
1.3720
1.3725
1.3730
1.3735
1.3740
1.3745
1.3750
1.3755
1.3760
1.3765
1.3770
1.3775
1.3780
1.3785
1.3790
1.3795
1.3800
1.3805
1.3810
1.3815
1.3820
1.3825
1.3830
1.3835
1.3840
1.3845
1.3850
1.3855
1.3860
1.3865
1.3870
1.3875
1.3880
1.3885
1.3890
1.3895
1.3900
1.3905
1.3910
1.3915
1.3920
1.3925
1.3930
1.3935
1.3940
1.3945
1.3950
1.3955
1.3960
1.3965
1.3970
1.3975
1.3980
1.3985
1.3990
1.3995
1.4000
1.4005
1.4010
1.4015
1.4020
1.4025
1.4030
1.4035
1.4040
1.4045
1.4050
1.4055
1.4060
1.4065
1.4070
1.4075
1.4080
1.4085
1.4090
1.4095
1.4100
1.4105
1.4110
1.4115
1.4120
1.4125
1.4130
1.4135
1.4140
1.4145
1.4150
1.4155
1.4160
1.4165
1.4170
1.4175
1.4180
1.4185
1.4190
1.4195
1.4200
1.4205
1.4210
1.4215
1.4220
1.4225
1.4230
1.4235
1.4240
1.4245
1.4250
1.4255
1.4260
1.4265
1.4270
1.4275
1.4280
1.4285
1.4290
1.4295
1.4300
1.4305
1.4310
1.4315
1.4320
1.4325
1.4330
1.4335
1.4340
1.4345
1.4350
1.4355
1.4360
1.4365
1.4370
1.4375
1.4380
1.4385
1.4390
1.4395
1.4400
1.4405
1.4410
1.4415
1.4420
1.4425
1.4430
1.4435
1.4440
1.4445
1.4450
1.4455
1.4460
1.4465
1.4470
1.4475
1.4480
1.4485
1.4490
1.4495
1.4500
1.4505
1.4510
1.4515
1.4520
1.4525
1.4530
1.4535
1.4540
1.4545
1.4550
1.4555
1.4560
1.4565
1.4570
1.4575
1.4580
1.4585
1.4590
1.4595
1.4600
1.4605
1.4610
1.4615
1.4620
1.4625
1.4630
1.4635
1.4640
1.4645
1.4650
1.4655
1.4660
1.4665
1.4670
1.4675
1.4680
1.4685
1.4690
1.4695
1.4700
1.4705
1.4710
1.4715
1.4720
1.4725
1.4730
1.4735
1.4740
1.4745
1.4750
1.4755
1.4760
1.4765
1.4770
1.4775
1.4780
1.4785
1.4790
1.4795
1.4800
1.4805
1.4810
1.4815
1.4820
1.4825
1.4830
1.4835
1.4840
1.4845
1.4850
1.4855
1.4860
1.4865
1.4870
1.4875
1.4880
1.4885
1.4890
1.4895
1.4900
1.4905
1.4910
1.4915
1.4920
1.4925
1.4930
1.4935
1.4940
1.4945
1.4950
1.4955
1.4960
1.4965
1.4970
1.4975
1.4980
1.4985
1.4990
1.4995
1.5000
1.5005
1.5010
1.5015
1.5020
1.5025
1.5030
1.5035
1.5040
1.5045
1.5050
1.5055
1.5060
1.5065
1.5070
1.5075
1.5080
1.5085
1.5090
1.5095
1.5100
1.5105
1.5110
1.5115
1.5120
1.5125
1.5130
1.5135
1.5140
1.5145
1.5150
1.5155
1.5160
1.5165
1.5170
1.5175
1.5180
1.5185
1.5190
1.5195
1.5200
1.5205
1.5210
1.5215
1.5220
1.5225
1.5230
1.5235
1.5240
1.5245
1.5250
1.5255
1.5260
1.5265
1.5270
1.5275
1.5280
1.5285
1.5290
1.5295
1.5300
1.5305
1.5310
1.5315
1.5320
1.5325
1.5330
1.5335
1.5340
1.5345
1.5350
1.5355
1.5360
1.5365
1.5370
1.5375
1.5380
1.5385
1.5390
1.5395
1.5400
1.5405
1.5410
1.5415
1.5420
1.5425
1.5430
1.5435
1.5440
1.5445
1.5450
1.5455
1.5460
1.5465
1.5470
1.5475
1.5480
1.5485
1.5490
1.5495
1.5500
1.5505
1.5510
1.5515
1.5520
1.5525
1.5530
1.5535
1.5540
1.5545
1.5550
1.5555
1.5560
1.5565
1.5570
1.5575
1.5580
1.5585
1.5590
1.5595
1.5600
1.5605
1.5610
1.5615
1.5620
1.5625
1.5630
1.5635
1.5640
1.5645
1.5650
1.5655
1.5660
1.5665
1.5670
1.5675
1.5680
1.5685
1.5690
1.5695
1.5700
1.5705
1.5710
1.5715
1.5720
1.5725
1.5730
1.5735
1.5740
1.5745
1.5750
1.5755
1.5760
1.5765
1.5770
1.5775
1.5780
1.5785
1.5790
1.5795
1.5800
1.5805
1.5810
1.5815
1.5820
1.5825
1.5830
1.5835
1.5840
1.5845
1.5850
1.5855
1.5860
1.5865
1.5870
1.5875
1.5880
1.5885
1.5890
1.5895
1.5900
1.5905
1.5910
1.5915
1.5920
1.5925
1.5930
1.5935
1.5940
1.5945
1.5950
1.5955
1.5960
1.5965
1.5970
1.5975
1.5980
1.5985
1.5990
1.5995
1.6000
1.6005
1.6010
1.6015
1.6020
1.6025
1.6030
1.6035
1.6040
1.6045
1.6050
1.6055
1.6060
1.6065
1.6070
1.6075
1.6080
1.6085
1.6090
1.6095
1.6100
1.6105
1.6110
1.6115
1.6120
1.6125
1.6130
1.6135
1.6140
1.6145
1.6150
1.6155
1.6160
1.6165
1.6170
1.6175
1.6180
1.6185
1.6190
1.6195
1.6200
1.6205
1.6210
1.6215
1.6220
1.6225
1.6230
1.6235
1.6240
1.6245
1.6250
1.6255
1.6260
1.6265
1.6270
1.6275
1.6280
1.6285
1.6290
1.6295
1.6300
1.6305
1.6310
1.6315
1.6320
1.6325
1.6330
1.6335
1.6340
1.6345
1.6350
1.6355
1.6360
1.6365
1.6370
1.6375
1.6380
1.6385
1.6390
1.6395
1.6400
1.6405
1.6410
1.6415
1.6420
1.6425
1.6430
1.6435
1.6440
1.6445
1.6450
1.6455
1.6460
1.6465
1.6470
1.6475
1.6480
1.6485
1.6490
1.6495
1.6500
1.6505
1.6510
1.6515
1.6520
1.6

Know FLEXIBLE SHAFTS
. . . as they are today!



Flexible shafts are far different from what they were a number of years ago. Here are a few of the differences.

Then: flexible shafts were available in comparatively small sizes only.

NOW: S. S. White offers a wide range of sizes up to .750' diameter.

Then: all flexible shafts were very much alike in construction and physical characteristics.

NOW: S. S. White Shafts come in types specially developed for power drives and for mechanical remote controls, with a broad selection of physical characteristics in each type.

Then: flexible shafts were all made of steel.

NOW: S. S. White makes them of different materials including those with non-magnetic and corrosion-resistant properties.

To KNOW Flexible Shafts is to USE them

The number and variety of new flexible shaft applications constantly appearing, indicate that many engineers are up-to-date in their knowledge of flexible shafts. You too, will find it helpful to have the latest information on hand when you design. Write and ask for the **FLEXIBLE SHAFT BULLETINS.**

S. S. WHITE

The S. S. White Dental Mfg. Co.
INDUSTRIAL DIVISION
Dept. H, 10 East 40th St., New York, N. Y.

FLEXIBLE SHAFTS for POWER DRIVES, REMOTE CONTROL and COUPLING

Hob Centering Gages

For the general run of spur and helical gears, therefore, a hob centering gage is not necessary. It has been our experience that it is much more important to have the hob run true than to centralize on any particular tooth or space, and, for very precise work, to select the most accurate zone in a given hob by axially shifting it to various positions. The errors produced in tooth forms from eccentrically running hobs, and from lead, spacing and form errors inherent in the hobs, sometimes amount to many times the error from generating flats, for it should be remembered that even if a hob is set central, it does not necessarily follow that accurate tooth forms will be produced. The combined effect of the errors in the hob, and particularly the hob setting, must still be considered.

Setting Up Hobs

Many users of hobbing machines fail to realize the full importance of proper hob setting. The necessity of having the hob running true, and centralizing it on a tooth or a space when low numbers of teeth are cut, is common knowledge; but the selection of the best cutting zone in a given hob to produce tooth forms of the highest possible accuracy, is not so widely understood nor appreciated.

It is not recommended that all of the refinements in hob setting hereinafter described should be indiscriminately employed in the setup for small lots of "commercial" accuracy because of the added expense involved. However, for gears requiring the utmost quietness and smoothness of operation, as in turbine reduction sets, automobile transmissions, timing gears, and printing press machinery, selecting the proper hob setting is often responsible for the satisfactory performance of gears that would otherwise have been rejected.

Hob Run-out

Obviously the first consideration in setting a hob is its fit on the arbor. There should be no play; otherwise it may shift while cutting and the most careful set-up will be of no avail.

The next step is to clamp the hob on the arbor, using a minimum of spacing collars. The outer bearing should be in place before applying the wrench to the clamping nut, otherwise the arbor may be damaged by springing it out of line.

The hub or proof diameters should be checked by means of an indicator graduated in ten-thousandths of an inch. An indicator graduated in half-thousandths or thousandths cannot be relied upon for this class of work. Run-out should be within .002", and the high points of the run-out on each end of the hob should be in line. Any eccentricity will produce an error in tooth form, particularly when the high points of the run-out are opposite on the two ends of the hob.

If the run-out of the hub diameters exceeds the limit stated, it can be corrected readily by loosening the clamping nut, rotating the spacing collars, and re-clamping. The slight errors in parallelism of the faces of the collars are thereby utilized to bring the hob into correct alignment. It may be necessary to repeat this process a few times before the hob runs satisfactorily. With a little practice the operator will be able to true up the hob in a few minutes time. This is one of the most important elements in hob setting, and it will be found that the extra time required will be amply justified by results.

Chart 3 is a table showing hob tolerance on ground form Class "A" and Class "B" hobs. It is very necessary in the first place to make hobs accurately, when precision gears are required, and it is equally important to see that the hob is sharpened properly and mounted properly on the machine. Otherwise, all the good that has been put into the hob is destroyed when a hob is mounted inaccurately. In other words, if a hob runs out on a hobbing machine, it has the same effect as a "drunken" lead.

Limits

To avoid the necessity of specifying limits for each job; as a time saver; as assurance that all Mitco hobs will be accurate within the stated limits, this arbitrary set of limits has been established.

PRIDE OF POSSESSION

THERE GOES BORROWIN' PETE AGAIN—TRYIN' TO WHEEDLE MAC'S PET NICHOLSON FILES AWAY. WAIT'LL YOU HEAR MAC EXPLODE.
YEAH! MAC'D JUST AS SOON LEND PETE HIS LAST PAIR O' PANTS. I DON'T BLAME HIM BEIN' FUSSY ABOUT HIS TOOLS—MAC KNOWS HOW TO USE 'EM
I ONLY WANT 'EM F'R A COUPLA SPECIAL DRIVE-FIT JOBS I'M DOIN' F'R THE BOSS
NICHOLSON U.S.A. MADE IN U.S.A.

FLAT BASTARD
A popular Nicholson File for rapid metal removal

• "Show me a workman who's a fuss-budget about his tools, and I'll show you a workman who is worth his weight in gold," says the veteran Shop Foreman.

First of all, he won't be satisfied with any but top-quality tools. And if it's files, it's ten-to-one his choice is a first-quality Nicholson or Black Diamond. Especially if he's an old-timer who's tried 'em all. . . .

Because — *there IS a difference.*

Since 1864 Nicholson has devoted itself to making *one* line of products — and making that line unbeatably well . . . FILES. Tests, checks and laboratory controls follow Nicholson Files so watchfully through every stage of production that Nicholson guarantees "*Twelve perfect files in every dozen.*"

NICHOLSON FILE COMPANY
Providence, Rhode Island, U. S. A.
Canadian Plant, Port Hope, Ontario

NICHOLSON FILES

FOR EVERY PURPOSE

NICHOLSON U.S.A. MADE IN U.S.A.

"A" limits should be specified when more than usual accuracy is required.

Limits for Single and Multiple Thread Ground Finishing (Spur and Spiral) Gear Hobs

DIAMETRAL PITCH			1 to 1½	2 to 2½	3	4	5	6 to 12	13 to 20
HOLE DIAMETER									
Must be tapped straight, parallel, not less than 75% bearing length									
Hole within plus only		A	0100	0025	0013	0012	0012	0002	0004
		B	001	0007	0005	0003	0001	0001	00025
HUB RUN OUT									
Face within		A	0008	0025	0013	0012	0002	0002	0002
		B	001	0007	0005	0003	00025	00025	00025
Diameter within		A	001	0025	0014	0013	0003	0003	0003
		B	0012	0008	0005	0003	0003	00025	00025
Run Out	Up to 3" Diameter	A						001	001
		B						0005	0004
	3 to 6" Inclusive	A					0015	001	001
		B					0015	001	0004
	Over 6" Diameter	A	002	002	0015	0015	0015	001	001
		B	004	003	0015	0015	0015	001	
Spacing from hole to hole within		A	004	003	0025	002	0015	001	001
		B	002	0015	001	001	001	001	0005
Accumulated error in one revolution must not exceed		A	010	009	008	007	005	003	003
		B	012	010	008	008	005	004	004
CUTTING FACES									
Must be radial within		A	003	0015	001	0008	0006	0005	0003
Cutting Depth		B	005	0025	0015	001	0008	0007	0003
THREAD									
Lead variation in any one complete turn must not exceed		A	0025	002	001	0008	0006	0005	0004
		B	0035	0025	0015	0011	0010	0008	0006
Lead variation from tooth to tooth must not exceed		A	0007	0005	004	0003	0002	0002	0002
		B	001	0008	0007	0006	0005	0004	0003
TOOTH PROFILE OR PRESSURE ANGLE									
Must be symmetrical within		A	001	0007	0005	0004	0003	0002	0002
		B	0015	001	0006	0005	0004	0003	0003
Straight portion within		A	001	0005	0003	00025	0002	00015	0001
		B	0016	0008	0005	0004	0004	0002	0002
Start of approach within plus or minus		A	130	118	015	010	010	010	005
		B	022	020	015	010	010	010	005
Approach on each side of tooth symmetrical within		A	015	0120	010	0068	006	005	005
		B	015	012	010	008	006	005	005
Tooth thickness within (minus only)		A	003	002	0015	0015	001	001	001
		B	002	002	002	002	002	001	001
MULTIPLE THREADS									
Circular Pitch Within		A							
		B	005	003	0030	0015	0010	0007	0005

* The classification of a hob is determined by the finest limit of any one feature.

CHART No. 7

The classification of a hob is determined by the finest limit of any one feature.

"B" limit hobs will suffice for ordinary commercial tolerances with a corresponding accuracy.

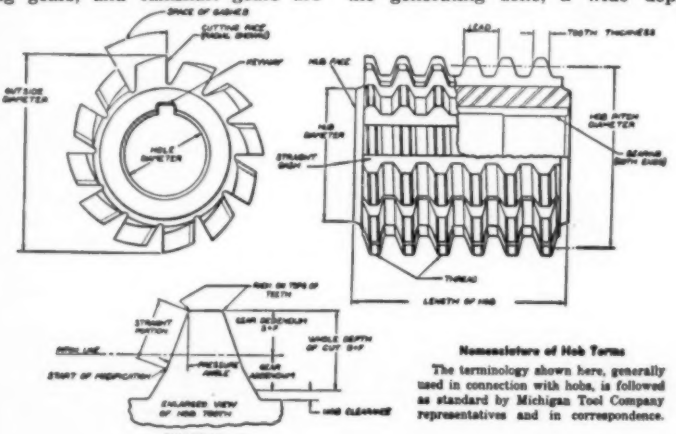
When automobile transmission gears, timing gears, and camshaft gears are finished by the hobbing method, hobs with "A" tolerances should be used. When finished by some other method, such as shaving, etc., hobs with "B" tolerances can be used with satisfactory results.

Composite Effect of Errors in Hob Teeth

The composite effect of errors in the hob teeth is another important element influencing tooth form. Even though the most accurately ground hob obtainable is used, the errors of which may be within .002" for form, tooth spacing, and weave, the combined effect of these errors may affect the form several times the amount of the individual hob tooth errors.

For example, suppose a hob has 60 teeth, 25 of which comprise the cutting zone (Fig. 10) when producing a certain gear. Of the 25, perhaps 10 serve as roughing teeth only, and the remaining 15 actually generate. Each of these 15 teeth will form a portion of the involute curve (See Fig. 2.)

It will be seen readily that, although each tooth, individually, may be accurate, errors in spacing will cause certain teeth to cut too much on one side and not enough on the other, thus modifying the involute considerably. It may appear that, with 15 teeth in the generating zone, a wide depart-



Nomenclature of Hob Terms

The terminology shown here, generally used in connection with hobs, is followed as standard by Michigan Tool Company representatives and in correspondence.

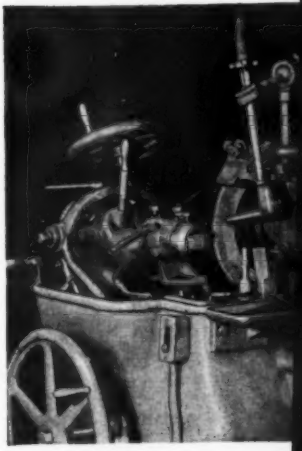
Why hold up production by putting skilled machinists on Tool Grinding

Sellers 20W Tool Grinder

OF course, machinists like to grind their own tools . . . they also have their own ideas of how tools should be shaped and what clearance they should have. All of them cannot be right—a machinist at best seldom grinds two tools alike.

Why pay skilled machinists to grind tools? An expensive machine stands idle . . . production is held up! Have your tool room attendant do this job. With a Sellers Tool Grinder, he can grind tools better than the best machinist can by hand . . . and in less time. Less tool steel will be wasted and the tools will last longer and cut better. And your machinist can be kept on the work you are paying him to do.

If you are looking for a way to save money and keep production at peak, we know you will want more information about Sellers Tool Grinders.



WILLIAM SELLERS & CO., Inc.
1616 HAMILTON ST. PHILADELPHIA, PA.

SELLERS 1848

Sellers

ure from the true involute is possible. In practice, however, the errors cancel each other to a large extent. By shifting a hob axially, different composite sets of teeth of the hob comprise the generating zone. By this means it is possible to select one or more best positions of a given hob when cutting a gear of a given number of teeth.

Setting Up for Extreme Precision

To select the best positions of a hob, it should be set first approximately central with the blank, or if the helix angle is high, it should be offset from the central position to favor more cutting teeth toward the lower end. A trial cut should then be made, either on the gear proper or a dummy cast iron blank.

On large gears, where trial cuts for involute inspection are impractical, dummies of convenient size may be used for involute and speeder tests. The number of teeth in the dummy representing the gear should not be too low, preferably not under 50, except in the larger pitches. The helix angle should be preferably the same as the gear it represents.

The error in involute form of the teeth of the gear or dummy should be inspected on a suitable instrument, to determine if it is within the desired limits of .0002" to .0004" and if it is off balance (that is, if it "leans" one way or the other). If it is not satisfactory, the hob should be shifted axially a few thousandths either way, and the trial cut repeated. In shifting the hob axially, the entire cutter spindle unit is moved by turning the nut provided for that purpose, thus making it unnecessary to disturb the setting of the hob on the cutter arbor.

If, after several trials, a satisfactory tooth form has not been attained, the hob should be shifted to utilize an entirely different portion, one or more convolutions away.

If the mating pinion is to be cut on another machine, it is desirable to set it up at the same time and make similar cuts. Then, in addition to the involute tests, the pair of trial gears or dummies should be mounted on centers or on a speeder at the proper backlash, coated with red lead, and rolled to show the tooth bearing. Care should be taken in mounting, to have the profiles of the dummies contact in the same relation as that in which the final gears are to be run.

Ideal Tooth Contacts

Generally speaking, the ideal initial spur gear bearing is a full contact fading out at the top and bottom of the tooth; the ideal initial helical gear bearing is a narrower contact at, and above and below, the pitch line. A split line bearing is particularly objectionable. If the gears are to run in both directions, or if the exact relation of the gears at assembly cannot be controlled, it is, of course, necessary that the form be balanced as accurately as possible on both sides of the tooth. In many cases, however, where a pair of gears are to be run only or mainly in one direction and one relation, the driving side of the teeth can be favored and little or no attention paid to the other side. In this way much time can be saved.

Trial Speeder Check

The pair of dummies, or trial gears, when mounted on the speeder should be run at proper pitch line speed with a suitable brake load and judged for noise. This is even more important than the involute inspection; in fact, this test in conjunction with the red lead test for contact, is often used for obtaining the best hob positions without measuring the involute form at all. The principal advantage of the involute check is that it shows which gear is at fault, whereas with the speeder test it is often difficult to tell whether one or both gears are responsible for the poor contact or noise.

When the same hobbing machine is to be used for both a spur pinion and gear, two dummies may be cut together and tried for involute and noise. Sometimes, if helical gears are to be cut on the same machine, it is advantageous to cut spur dummies for each hob, and thus save considerable time and expense. In this case the dummies should be inspected for involute and contact with red lead, but not for noise, because a hob which produces a quiet helical gear will not necessarily produce a quiet spur gear. Whenever

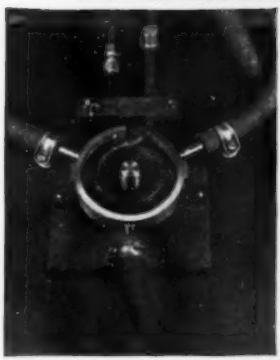
JACOBS CHUCKS

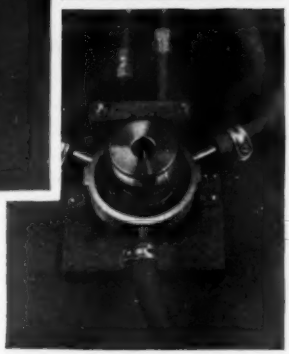
ARE NOW

TOCCO

HARDENED

JACOBS constant modernizat results in consistent major impro ments for Jacobs Chucks. In he treating, Jacobs has just instal this modern Tocco Hardening M chine which treats Plain Bear Chuck Bodies so that only those pa subject to wear are selectively s face-hardened, while absolutely avo ing distortion and maintaining original close accuracy of the Bodie with positive duplication of resu This extremely high standard of ha ening is accomplished by high quency electrical induction wh passes a 250,000 cycle curr through the coil shown in the ins surface-heating only the area to hardened to 1450° F. within a seconds. Previously set controls termine length of heating, dwell automatic quench to split-sec accuracy. Once again Jacobs Chu lead . . . more strength, finer ac racies, longer life.





IF IT'S A

Jacobs

IT HOLDS!

THE JACOBS MANUFACTURING COMPANY. HARTFORD, CON

hobs are made for helical gears with a modified involute form to concentrate a broad bearing on the pitch line, the dummy spur gears will have a duration of contact too short for full tooth action, and helical dummies are advisable.

Limitations of "Dummies"

Strictly speaking, the use of dummies as a means of obtaining proper tooth bearing is not a theoretically correct method if they differ in number of teeth or in helix angle from the gears they represent. For example, suppose the number of teeth in a gear is 100, and the dummy has 50 teeth. Obviously, the duration of contact between hob and dummy is less than between hob and gear proper, and the number of hob teeth which generate is correspondingly fewer. Therefore a good tooth form on the dummy is no positive indication that there will be a similar good form on the gear, because the extra generating teeth on the hob in this case modify the results. Theoretically, this is true, but for all practical purposes it can be neglected so long as there are a reasonable number of teeth on the dummy. The reason for this is that the additional generating hob teeth in question affect the involute only at the extreme top and bottom of the profile, the essential central portion of the tooth form remaining substantially unchanged.

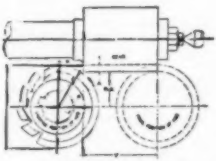
Recording Hob Positions

When satisfactory positions for a hob have been determined, these should be recorded by means of a special micrometer setting device attached to the machine. The high points and amount of run-out may be marked on the hob with blue vitriol solution. Thus, on future jobs, the hob positioning can be duplicated without resorting to trial or dummy gears. Frequently, several good positions will be found on one hob, all of which can then be utilized before sharpening is required. Sharpening the hob may affect the form slightly. It is, therefore, best to repeat the trial cuts and check for form after each sharpening.

Effect of Machine Errors

Another important consideration in hobbing accurate gears is to be sure that the hobbing machine is in good mechanical condition. By good condition it is meant that ways and bearings on the machine must be in good condition. Also cumulative errors in the index and feed gears and also in the lead screw will show up in the gears being cut.

It is good policy, every so often, to check the angular velocity of the hobbing machine with instruments provided for this purpose.



Estimating Time Required for Hobbing Gears

X — The distance hob must feed from time it starts cutting until it reaches full cutting depth.
N — Number of teeth in gear.
Y — Length of face of gear or gears.
L — Number of threads in hob.
S — Revolutions per minute of hob.
F — Feed per revolution of gear blank.
A — Total depth of cut.
D — Diameter of hob.

FORMULA

(1) $\text{Time} = \frac{N\,(Y + X)}{S \times F \times L}$ (2) $X = \sqrt{A\,(D - A)}$

So formula may be written: $\text{Time} = \frac{N\,(Y + \sqrt{A\,(D - A)}}{S \times F \times L}$

EXAMPLE

GEAR:	HOB:
10 D.P.	3" Dia.
30 Tooth	Double Thd.
.2157 Whole Depth	90 R.P.M.
Face Width 1.5"	.050" Feed

$$\text{Time} = \frac{N\,(Y + \sqrt{A\,(D - A)}}{S \times F \times L}$$

$$\text{Time} = \frac{30\,(1.5 + \sqrt{.2157\,(3 - .2157)}}{90 \times .050 \times 2}$$

Time = 7.58

CHART No. 6

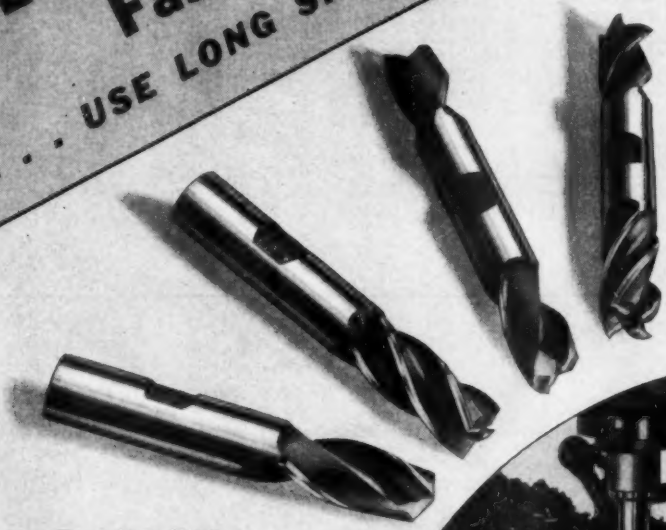
Multiple Thread Hobs

It is the practice at times when cutting gears of heavy pitches to take a rough and a finish cut, thus obtaining higher accuracy. In roughing, single, double, and triple thread unground hobs are used. It is not good practice to use greater than a triple thread hob for roughing because there will be no economy effected. The additional cost and variation of hobs greater than triple

for

Long Life — Fast Cutting —

. . . USE LONG SPIRAL END MILLS



- - - - - - These Long Spiral End Mills are made Single-End and Double-End, including Two-Lipped Mills - - - Right-Hand and Left-Hand - - - in a Wide Range of Sizes from 1/8" to 3/4" diameter. Other sizes to order.

Write for circular—Brown & Sharpe Mfg. Co., Providence, R. I., U. S. A.

B·S

BROWN & SHARPE CUTTERS

CUTTING SPEEDS

Diam. Inches	FEET PER MINUTE																			
	15	20	25	30	35	40	45	50	55	60	65	70	80	90	100	110	120	130	140	150
	REVOLUTIONS PER MINUTE																			
1/16	229	306	382	458	535	611	688	764	840	917	993	1070	1222	1375	1528	1681	1833	1986	2139	2292
1/8	153	204	255	306	357	407	458	509	560	611	662	713	815	917	1019	1120	1222	1324	1426	1528
3/16	115	153	191	229	267	306	344	382	420	458	497	535	611	688	764	840	917	993	1070	1146
1/4	92	122	153	183	214	244	275	306	336	367	397	428	489	550	611	672	733	794	856	917
5/16	76	102	127	153	178	204	229	255	280	306	331	357	407	458	509	560	611	662	713	764
3/8	65	87	109	131	153	175	196	218	240	262	284	306	349	393	437	480	524	567	611	655
7/16	57	76	96	115	134	153	172	191	210	229	248	267	306	344	382	420	458	497	535	573
1/2	51	68	85	102	119	136	153	170	187	204	221	238	272	306	340	373	407	441	475	509
9/16	46	61	76	92	107	122	138	153	168	183	199	214	244	275	306	336	367	397	428	458
5/8	42	55	70	87	101	125	139	153	167	181	196	222	250	278	306	333	361	389	417	
11/16	38	51	64	96	89	102	115	127	140	153	166	178	204	229	255	280	306	331	357	382
3/4	35	47	59	71	82	94	106	118	129	141	153	165	188	212	235	259	282	306	329	353
13/16	33	44	55	66	76	87	98	109	120	131	142	153	175	196	218	240	262	284	306	327
7/8	31	40	51	61	71	82	92	102	112	122	132	143	163	183	204	224	244	265	285	306
15/16	29	38	48	57	67	76	86	96	105	115	124	134	153	172	191	210	229	248	267	287
1	25	34	42	51	59	68	76	85	93	102	110	119	136	153	170	187	204	221	238	255
1 1/16	23	31	38	46	54	61	69	76	84	92	99	107	122	138	153	168	183	199	214	229
1 1/8	21	28	35	42	49	56	63	70	76	83	90	97	111	125	139	153	167	181	194	208
1 3/16	19	25	32	38	45	51	57	64	70	76	83	89	102	115	127	140	153	166	178	191
1 1/4	16	22	27	33	38	44	49	55	60	66	71	76	87	98	109	120	131	142	153	164
1 3/8	14	18	23	28	33	38	43	48	53	57	62	67	76	86	96	105	115	124	134	143
1 1/2	13	17	21	26	30	34	38	42	47	51	55	59	68	76	85	93	102	110	119	127
1 5/8	12	15	19	23	27	31	34	38	42	46	50	54	61	69	76	84	92	99	107	115
1 3/4	10	14	17	21	24	28	31	35	38	42	45	49	56	63	70	78	83	90	97	104
1 7/8	9	13	16	19	22	26	29	32	35	38	41	45	51	57	64	70	76	83	89	96
2	8	11	14	16	19	22	25	27	30	33	36	38	44	49	55	60	66	71	76	82
2 1/4	7	10	12	14	17	19	22	24	26	29	31	33	38	43	48	53	57	62	67	72
2 1/2	6	9	11	13	15	17	19	21	23	26	28	30	34	38	42	47	51	55	59	64
2 3/4	5	8	10	12	14	15	17	19	21	23	25	27	31	34	38	42	46	50	54	57
3	5	7	9	10	12	14	16	17	19	21	23	24	28	31	35	38	42	45	49	52
3 1/2	4	6	8	9	11	13	14	16	18	19	21	22	26	29	32	35	38	41	45	48

CHART No. 5

thread will more than offset the time saved in cutting, and the quality of the work will not be so good.

Cutting Speeds

It is just as important to run hobs at the proper speeds as it is to mount the hobs properly. If hobs are run too fast or too slow, highest efficiency cannot be obtained. The determining factors for hob speeds are the type of material being cut, its hardness, physical properties, and the quality of finish required. Chart No. 5 is useful in setting up a new job.

Hob Sharpening Hints

There are two very important reasons why hobs should be kept properly sharpened:

(1) Economy:—A sharp hob will cut much faster, use less power and wear much longer.

(2) Better Work:—A sharp hob will produce more accurate work, with a finish far superior to that obtainable from a hob not in first class condition.

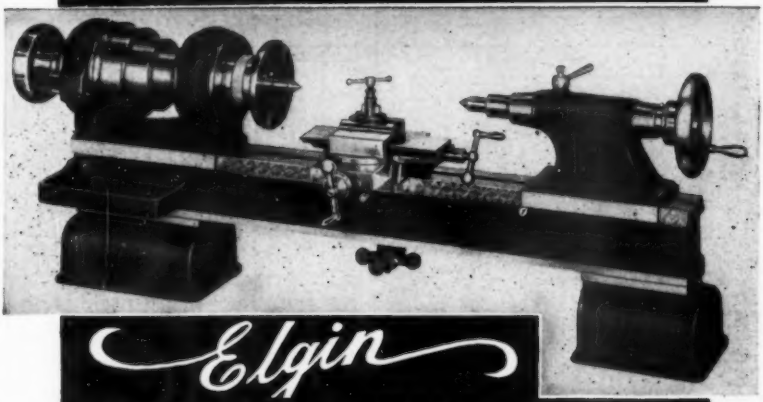
It is recommended that a bevel and concave wheel be used, medium grain and of soft grade—yet hard enough to prevent flying grit. The wheel should be kept clean; a glazed wheel may crack the hob teeth.

Too much metal should not be removed at a time with the grinding wheel since this will cause excessive heat and check marks in hob teeth.

A correctly sharpened hob tooth (A)

has neither of the common errors shown at (B) and (C) in the diagram. When a tooth is ground with an undercut (B) it will cut too deeply into

Does Your Lathe Have These New Features For Accuracy?



Elgin PRECISION BENCH LATHES

The Elgin Preloaded Ball Bearing Spindle Bench Lathe, designed to meet the present day requirements for speed and accuracy, is entirely new, embodying improvements covering fifty years of Precision Tool Manufacturing.

The Tailstock has a large dial on the hand wheel graduated to thousandths of an inch. Two half nuts lock the spindle without any misalignment.

The spindle is made of the finest grade of Through Hardening Steel (S. A. E. 52100.)

In Super Precision Duplex Preloaded Ball Bearings, metal to metal contact is obtained, assuring absolutely no end or radial play.

The extra heavy square Lathe Bed, and the Elgin Headstock are made of the finest grade cast iron, hand scraped to master gauges.

The Compound Slide Rest needs no wrench to lock it, and the graduated swivel swings 360°.

The Tool Post has a hardened plate fitting the T.Slot. Parts are pinned so they will not separate.

Made in ½" collet capacity with 7" swing—in ¾" and 1" collet capacity with 7" or 9" swing.

For more information, please write the

ELGIN TOOL WORKS

Division Of HARDINGE MANUFACTURING CO.

1772 BERTEAU AT RAVENSWOOD AVE. —CHICAGO, ILL.

Use this formula when changing from English pitch to module cutter. By conversion from table, the circular thickness, addendum, dedendum, and full depth can be figured.

Standard Diametral Pitch Cutters are made with 14½°, 20° and 22½° Pressure Angles. Circular Pitch Cutters: 14½° and 20° Pressure Angles.

Standard Stub-Tooth Cutters are Made with 20° and 22½° Pressure Angles

GEAR TOOTH PROPORTIONS

$$\text{Circular pitch} = \frac{3.1416}{\text{Diametral pitch}} = .32368 \times \text{Module}$$

$$\text{Diametral pitch} = \frac{25.4}{\text{Module}} \qquad \text{Module} = \frac{25.4}{\text{Diametral pitch}}$$

FULL LENGTH TEETH—ENGLISH PITCHES

Diametral Pitch	Circular Pitch	Dimensions in Inches: Circular Thickness	Addendum	Dedendum	Full Depth	Double Depth
4	13/16"	0.4862	0.2500	0.3333	0.5819	1.1638
	49/64"	0.3927	0.2500	0.3125	0.5625	1.1250
	25/32"	0.3750	0.2357	0.2945	0.5303	1.0606
	11/16"	0.3437	0.2188	0.2735	0.4923	0.9846
5	5/8"	0.3333	0.2100	0.2650	0.4750	0.9500
		0.3142	0.2000	0.2500	0.4500	0.9000
	49/64"	0.3125	0.1969	0.2406	0.4473	0.8950
6	9/16"	0.2813	0.1790	0.2238	0.4028	0.8056
		0.2618	0.1666	0.2083	0.3750	0.7500
	7/16"	0.2500	0.1589	0.1987	0.3576	0.7152
7	1/2"	0.2244	0.1428	0.1786	0.3215	0.6430
	7/16"	0.2187	0.1392	0.1741	0.3134	0.6268
8		0.1964	0.1250	0.1562	0.2813	0.5626
	3/8"	0.1875	0.1194	0.1493	0.2687	0.5374
9	11/32"	0.1745	0.1111	0.1389	0.2500	0.5000
10	5/16"	0.1666	0.1061	0.1326	0.2387	0.4774
		0.1571	0.1000	0.1250	0.2250	0.4500
	9/32"	0.1562	0.0995	0.1244	0.2239	0.4478
11		0.1428	0.0909	0.1136	0.2045	0.4090
12		0.1309	0.0833	0.1042	0.1875	0.3750
		0.1222	0.0778	0.0973	0.1751	0.3502
14	7/32"	0.1250	0.0796	0.0995	0.1791	0.3582
16		0.0982	0.0625	0.0781	0.1406	0.2813
	5/32"	0.0937	0.0597	0.0747	0.1344	0.2688
18		0.0873	0.0556	0.0695	0.1251	0.2502
20		0.0785	0.0500	0.0630	0.1130	0.2260
22		0.0714	0.0455	0.0569	0.1059	0.2118
24		0.0654	0.0417	0.0521	0.0964	0.1928
	1/8"	0.0625	0.0398	0.0498	0.0896	0.1792
28		0.0604	0.0306	0.0383	0.0919	0.1838
30		0.0561	0.0357	0.0507	0.0804	0.1728
32		0.0524	0.0333	0.0463	0.0818	0.1636
36		0.0491	0.0313	0.0462	0.0775	0.1550
40		0.0436	0.0278	0.0377	0.0655	0.1310
48		0.0393	0.0250	0.0350	0.0600	0.1200
		0.0327	0.0208	0.0309	0.0517	0.1034

STUB TEETH—ENGLISH PITCHES

Diametral Pitch	Dimensions in Inches: Circular Thickness	Addendum	Dedendum	Whole Depth of Tooth	Double Depth of Tooth
3-4	0.5236	0.2500	0.3125	0.5625	1.1250
4-5	0.3927	0.2000	0.2500	0.4500	0.9000
5-7	0.3142	0.1429	0.1786	0.3215	0.6430
6-8	0.2618	0.1250	0.1563	0.2813	0.5626
7-9	0.2244	0.1111	0.1389	0.2500	0.5000
8-10	0.1964	0.1000	0.1250	0.2250	0.4500
9-11	0.1745	0.0909	0.1136	0.2045	0.4090
10-12	0.1571	0.0833	0.1042	0.1875	0.3750
11-14	0.1428	0.0714	0.0893	0.1607	0.3214
12-14	0.1309	0.0714	0.0893	0.1607	0.3214
14-18	0.1122	0.0556	0.0705	0.1261	0.2522
16-21	0.0982	0.0476	0.0626	0.1102	0.2204
18-24	0.0873	0.0417	0.0566	0.0983	0.1966
20-26	0.0785	0.0386	0.0533	0.0919	0.1838
22-29	0.0714	0.0345	0.0494	0.0839	0.1678
24-32	0.0654	0.0313	0.0462	0.0775	0.1550
26-35	0.0604	0.0286	0.0385	0.0671	0.1342
28-37	0.0561	0.0270	0.0371	0.0641	0.1282
30-40	0.0524	0.0250	0.0350	0.0600	0.1200
32-42	0.0491	0.0238	0.0338	0.0576	0.1152
34-45	0.0462	0.0222	0.0322	0.0544	0.1088
36-48	0.0436	0.0208	0.0309	0.0517	0.1034
38-50	0.0413	0.0200	0.0300	0.0500	0.1000
40-54	0.0393	0.0185	0.0285	0.0470	0.0940

CHART No. 8

the work. When ground ahead of center, as at (C), the tooth has a tendency to drag over the work. Either of these errors will produce an incorrect form and should be avoided carefully.

Care must be used to maintain correct flute spacing. If some of the hob teeth are ground farther back than others (D), causing a reduction in tooth height (E), only the remaining teeth will do all the work. This means faster wear and irregularity of cutting action and the form of the gear teeth will not be the same on both sides.

Hobs made with a hook, (for special work), can be sharpened satisfactorily, provided the amount of hook, marked on the hub, is carefully maintained.

Sharpening guides for use on ordinary tool grinders, can be supplied for spiral gashed hobs.

Formula

Factors that must be known in figuring Worms and Worm Gears:

1—Center Distance.
2—Number of Threads on Worm.
3—Number of Teeth in Gear.
4—Pressure Angle.
5—Linear Pitch (which is measured parallel to the axis of the worm). If the normal pitch is given, the linear can be figured, or vice versa:

Addendum equals Linear Pitch x .3182.

Dedendum equals Linear Pitch x .3683.

Clearance equals Linear Pitch x .05.

Whole Depth equals Linear Pitch x .6866.

Pitch Diam. equals Linear Pitch x .3183 x Number of Teeth in Gear.

Outside Diam. equals Pitch Diameter plus two addenda. (This is also called the throat diameter.)

Root Diameter equals Pitch Diame-

PRECISION

IS A

"work-word"

AT

Cushman

WALK down the "production line" with me at Cushman Chuck. Here are the finest machine tools that money can buy. Here is a plant that is really modern, constantly kept up todate, thoroughly well run. Here are careful, thoughtful men who can't be hurried at their work, who make every smallest part of every Cushman Chuck as nearly perfect as is humanly possible.

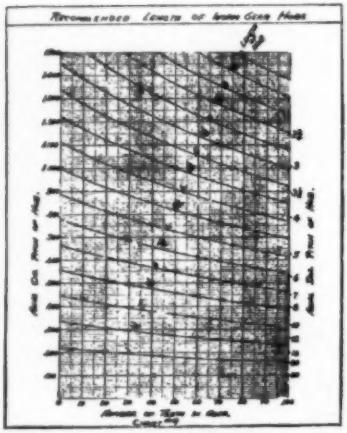
The photograph shows, for example, how finished Chucks are tested for centering accuracy on gauge bars in 11 different diameters. They must be accurate within .003" total indicator reading before going into stock.

Cushman realizes that machine tools can be no more accurate or dependable than their work-holding equipment. And Cushman takes this responsibility seriously. Consult our Engineering Department.

THE CUSHMAN CHUCK COMPANY, HARTFORD, CONNECTICUT

CUSHMAN CHUCKS

A WORLD STANDARD for PRECISION



ter minus two dedenda.

Helix Angle of Gear equals 90° minus angle of worm thread with its axis.

Pitch Diameter of worm equals 2 x center distance minus pitch diameter of gear.

Outside Diameter of Worm equals pitch diameter plus two addenda.

Root Diameter of worm equals pitch diameter minus two addenda.

Cotangent of Helix Angle of Worm equals pitch diameter x 3.1416 divided by lead.

Lead and Linear Pitch are the same on a single thread worm.

On a Multiple Thread Worm, lead equals linear pitch x number of threads in the worm.

Linear Pitch equals normal pitch x secant of helix angle or normal pitch divided by cosine of helix angle.

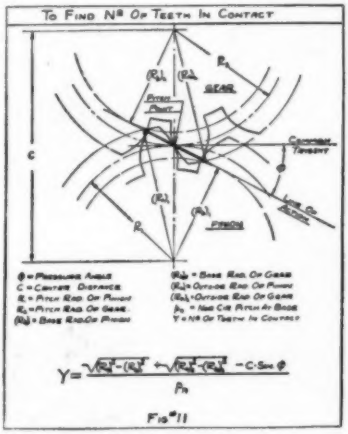


Fig. 11

For External Gears.

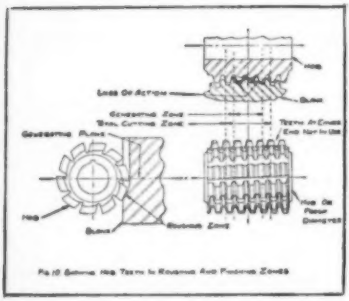


Fig. 10 Showing How Teeth In Roughing And Finishing Zones

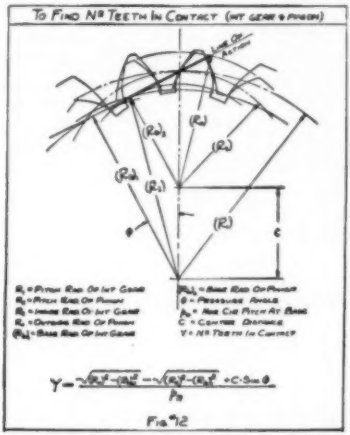
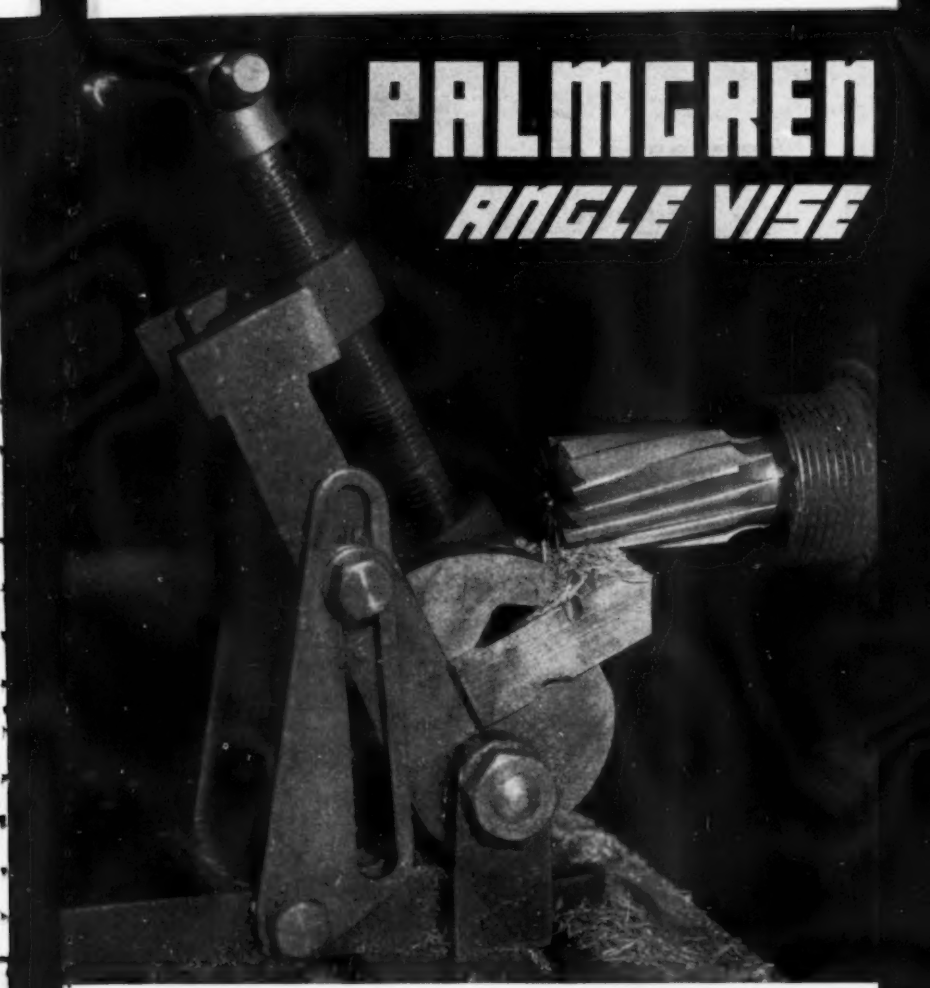


Fig. 12

For Internal Gears.

PALMGREN
ANGLE VISE



Tough Angle Jobs Easy with PALMGREN Angle Vise

Angle jobs set up quickly without the use of clamps, wedges or other makeshift methods.

For production or tool room work. For drilling, milling, grinding, it's graduated. Furnished with or without graduated swivel base.

CHICAGO TOOL & ENG. CO.

8363 SOUTH CHICAGO AVE., CHICAGO, ILL.

HINTS
for Magnetic Chuck Users:

Case No. 1—A prominent manufacturer had been grinding lathe beds to "tenths" and then distorting the beds several thousandths hauling them free from the magnetic chuck with a power hoist.

NEU-T-ROL solved this problem, promptly and fully releasing the lathe beds from the magnetic chuck.

Case No. 2—A maker of refrigeration equipment had been forced to institute a lapping operation, repairing compressor valve discs marred in prying loose from magnetic chucks.

NEU-T-ROL eliminated this lapping operation entirely, promptly freeing and demagnetizing the discs.

Case No. 3—A knife manufacturer had been hammering large shearing knives free from magnetic chucks with a babbitt hammer. This meant occasional chipping or breakage of knives.

NEU-T-ROL eliminated all need of hammering, doing away with the damaging and loss of knives, which in a single instance would have exceeded the cost of NUE-T-ROL equipment.

NEU-T-ROL saves time and trouble with small magnetic chucks. It is ESSENTIAL with big chucks. If you use Magnetic Chucks, you need NEU-T-ROL. Leading manufacturers can now supply NEU-T-ROL built-in on your new equipment—if you specify it! Write TODAY for full information.

Electro-Matic Products Co.
4036 N. Kolmar Ave.,
CHICAGO, ILLINOIS

Linear Pitch x Cosine of Helix Angle equals normal pitch.

½ Normal Pitch equals tooth thickness in normal section.

Tangent of Axial Pressure Angle x cosine of Helix Angle equals tangent of normal pressure angle.

Figuring Corrected Tooth Dimensions

"N" equals number of teeth in gear.

90°/N equals angle subtended by one half of circular tooth thickness.

Addendum plus (Pitch Radius of gear) minus (Pitch Radius of gear x cosine of 90°/N) equals corrected addendum.

(Pitch Radius of gear x sine of 90°/N x 2) equals chordal thickness of gear tooth.

It is not necessary to figure the corrected tooth thickness or the corrected addendum for worms that are used for commercial purposes.

The formula given in Figs. 11 and 12 are useful when designing gears or in case it is desired to modify the tips of the gear teeth so that continuity of tooth action will not be dangerously impaired.

Precision

TEST INDICATORS

$5.00

The Koch is the only Indicator with balanced torsion as well as compression springs, assuring positive and sustained accuracy. Each graduation on the scale represents 1/1000 of an inch movement of the plunger. Plunger moves away from instead of towards the lever, preventing breakage of delicate parts by sudden shocks. Dependable in service—low in first cost—worthy of your investigation. *Send for bulletin.*

The Koch Test Indicator
29 2nd Ave. - Nyack, New York

NEW!
CP 806 Midget Drill; weight only 3 3/8 lbs.; overall length only 7 5/8"; capacity only 3/16", available in three speeds.
CP 806 Midget Screw Driver and Nut Runner; weight only 4 1/2 lbs.; overall length only 11 1/4"; positive or cushion clutches; capacity, No. 8 wood screws or 3/16" machine screws; 3/16" nuts or bolts; available in four speeds.

DESIGNED for the PRODUCTION LINE

Built to stand up in continuous service . . . with a minimum of maintenance . . . are these latest MIDGET additions to the CP line of Universal Electric Tools

CP 806 Drill for 3/16" drilling in metal or wood
CP 806SC Screw Driver and Nut Runners for No. 8 wood screws, 3/16" machine screws and 3/16" bolts or nuts

For complete information, write for a copy of SP 2005.

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 6 EAST 44th STREET, NEW YORK, N. Y.
Sales Offices and Service Stations Throughout the World

CP UNIVERSAL ELECTRIC TOOLS
DRILLS • SCREW DRIVERS • NUT RUNNERS • TAPPERS • GRINDERS • SANDERS

Atlas F-SERIES 10" LATHES

Power Cross Feed Standard Equipment

Whatever the Job . . . These Features Help You Do It Easier and Better!

You buy a lathe with definite things in mind: Precision workmanship—simple, convenient operation and complete versatility—dependable, long-life construction. And price is usually important. In all these respects you'll find many of America's leading tool rooms and shops advising—"Get the modern Atlas." Here are some of the reasons why:

- ***Power Cross Feed*** standard equipment. Atlas is the only low-cost precision lathe giving you this feature that saves much laborious work on facing operations.
- ***Precision-Ground Bed***—first essential of a precision lathe. All six Atlas bearing surfaces are aligned to within .001 in all planes.
- ***Custom-Bored Spindle Bearings positively aligned by boring after the headstock has been fitted to the bed.***
- ***Backgeared Power—Complete V-Belt Drive—Wide Screw-Cutting Range — Quick-Change Countershafts—Rugged Zamak Alloy Parts—at no extra cost.***
- ***Sensible Prices.*** The 10" horizontal countershaft model above is $104.75 complete as shown less motor—with vertical (attached) countershaft only $99.75.

Whatever the job, you can do it easier and better with an Atlas Lathe. See them at your dealer's and send the coupon below for your 1940 Catalog.

"Rugged, powerful, accurate, versatile," say shop men everywhere.

"Ideal for small part precision work."

ATLAS PRESS COMPANY

250 N. Pitcher St., Kalamazoo, Mich.

NEW YORK 30 W. 42nd St. | CHICAGO 35 E. Wacker at Wabash | PHILADELPHIA 113 N. Third St.

ATLAS PRESS CO.
250 N. Pitcher St., Kalamazoo, Mich.

Please send me your 1940 Catalog on ☐ 10" Metal Lathes ☐ 6" Metal Lathes ☐ 7" Metal Shaper ☐ Drill Presses ☐ Arbor Presses ☐ Motors and Grinders ☐ Drill Grinding Attachment.

Name .....

Company .....

Address .....

City and State .....

Cutting Off Tools

An Informal Discussion of Cutting Off Tool Designs and Their Performance

By J. Milton Luers*

THERE are three major causes for failure or breakdown of a cutting off tool:—First, insufficient side clearance at 1 (sketch A); second, insufficient back clearance at 2 (sketch B); third, and the paramount cause, restricted normal expansion of the bursting chip 3 (sketch A) as it parts from the solid mass. This restriction of the expansion of the chip is caused by the side walls 4-4 (sketch A) and generates great frictional heat in the chip itself.

Side Clearance—

In the matter of insufficient side clearance at 1 (sketch A), the sharp cutting edge of a metal cutting tool is not retained in the same sense, for example, as that of a razor, because penetration of the metal being cut immediately slightly rounds the cutting edge of the tool as at 7 (sketch D). Now this rounding or changing in form of the sharp edge of the cutting off tool, caused by contact with the metal being cut, very gradually increases to the general form 8 (sketch D) forming parallel sides at 9-9 (sketch D), when the tool loses its clearance entirely, necessitating sharpening, otherwise it jams in the cut and breaks.

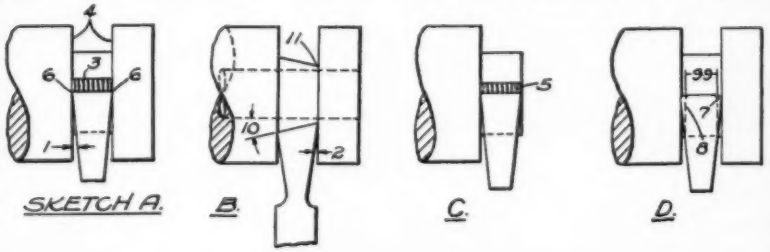
These parallel sides 9-9 (sketch D), or loss of clearance, are quickly worn on a forged tool or beveled blade because sufficient side clearance at 1 (sketch A) cannot be ground or formed on a forged tool or beveled blade without destroying the depth of the blade section.

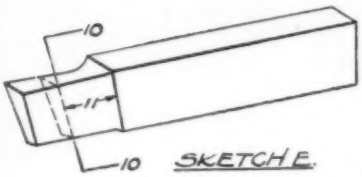
Back Clearance—at 2 (sketch B) is important as it completes the clearance of the cutting off tool on all planes from the two outside cutting points 6-6 (sketch A) thereby greatly increasing the freedom of cut.

Restricted Expansion of Bursting Chip—

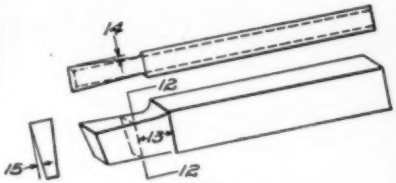
If you turn the end of a bar down with a cutting off tool (sketch C) normal pressure, abrasion, friction, and heat occur, as is the case in any turning operation. As chip 5 (sketch C) parts from the bar it is free to expand or burst, because the cut is open to the right and as a result the tool cuts very freely.

Now, when you move the cutting off





SKETCH E.



SKETCH F.

tool to its normal position (sketch A) it starts to cut quite as freely as shown in (sketch C) where the chip was free to expand to the right yet, after cutting into the bar a fraction of an inch, a definite change occurs because the chip which is solid metal the width of the cut off slot as it is cut from the bar instantly bursts into many small parts as indicated by the broken chip section 3 (sketch A). In the same instant walls 4-4 (sketch A) formed by the cut, jam or force these small particles which constitute the burst chip, back into practically its original solid form or width, the friction between these particles of the burst chip caused by this side wall restriction 4-4 (sketch A) generates great heat in the chip itself. This heat is added instantly and positively to the normal heat generated by parting the chip from the solid mass or bar. This total frictional heat conducted instantaneously to these two all important cutting points 6-6 (sketch A) of the cutting off tool rapidly breaks these points down, the tool has then lost its clearance, and must be removed from the machine and sharpened.

Not only must a cutting off tool withstand the normal heat, and other destructive factors incidental to the cutting action, but the additional burden of frictional heat generated by side walls 4-4 (sketch A) restriction of natural expansion or bursting occurring in small sections or chips of metal when cut from the solid mass.

Why Tools Breakdown

What is stressed here is that restricted normal expansion of the bursting chip and resultant additional chip heat generated by this restriction primarily is responsible for the rapid breakdown and short life of cutting off tools.

For many years what is known as a forged cutting off tool (sketch E) was and is used still. Then there is available the beveled blade (sketch F) held in a holder of a sort designed for that purpose. These two types of cutting off tools do not give complete satisfaction, yet generally, these types were the only tools available for the purpose.

Among the several disadvantages of the forged cutting off tool can be mentioned the original cost of forging and grinding to form (sketch E); the expense of removing it from the machine and consequent loss of its position in relation to the other tools in the setup; then the time required to remove, sharpen, and properly reset a forged tool. When a forged cutting off tool is reduced by sharpening to 10-10 (sketch E) it must necessarily be reforged, dressed and ground. It also lacks sufficient side clearance, but does possess the rigidity of a solid tool.

The beveled blade (sketch F) has insufficient side clearance at 15 (sketch F), and no back clearance. So common practice was and is to grind clearance on an end of the blade at 14 (sketch F) to the same angular or clearance proportions of the forged tool at (sketch E.) When the beveled blade (sketch F) requires sharpening the idea is that it can be removed from the holder, sharpened, and replaced in its holder, thus preserving the original setting of the cutting off tool in relation to other tools in the setup. When it has been reduced by sharpening to

Bridgeport

TURRE' MILLINC MACHINI

Rigidity
Flexibility
Unparallele
Range

The most diffic milling, drilling a boring jobs are e with the new Bridgepc Here are a few of advanced modern f tures that make su performance possibl

Angular settings one plane are achiev by turning the ha wheel which controls keyed overarm. Tur diameter is 15' with overarm.

Column, knee a table construction rugged with wide ways and ta gibs for accurate and vibrationl operation. Table, knee and sad locks are located in front for e accessibility.

Graduated dials are 3¼" diameter. Anti-friction bearin are used throughout.

Write for full details.

BRIDGEPORT MACHINES, INC.
52 REMER ST. BRIDGEPORT, CONN.

12-12 (sketch F) it is necessary to waste portion 13 (sketch F) and regrind a new cutting end as previously described.

What is vastly important, neither the forged tool nor the beveled blade have sufficient side clearance, or eliminated even in part, that most destructive factor operating against the efficiency of a cutting off tool in action, which is, restriction of the normal chip expansion and the heat generated by this restriction in the chip itself as it leaves the solid mass.

At this point, for further reference which will be made, we will consider the principle of the well-known opposed blade type of cutting off machine. The efficiency and easy cutting off action of this type machine is due entirely to the absence of restriction of chip expansion. Briefly this is how it works:

On two opposed tables are mounted blades 16 and 17 (sketch G). These tables are fed simultaneously to center. Narrow tool 16 is set a fraction of an inch, at 18, closer to center than is wide tool 17. The feed permits narrow tool 16 to penetrate the revolving bar to a depth of say .010 of an inch and 22 width (sketch G). That depth forms no chip restricting walls, yet the operation would quickly form walls were it not for wide tool 17, fed simultaneously from the opposite side of the bar, which continually cuts the walls away at chip width 19 and 20, forming cut off width 21 (sketch G). True, wide tool 17 forms side walls yet these walls do not restrict the chip expansion because chips 19 and 20 are free to expand to the center of cut 21, for the center of cut 21 (sketch G) is continually cut out or cleared by narrow tool 16 on the opposite side of the bar and set slightly ahead of wide tool 17.

The three separate chips 22, 19 and 20 (sketch G) making up cut off width 21 are each free to expand and add no additional chip heat to tools 16 and 17. This unrestricted chip expansion is the only reason for the remarkably free cutting off action of the machine.

A practically perfect cutting off tool is:

A blade that has sufficient side and back clearance throughout its length—

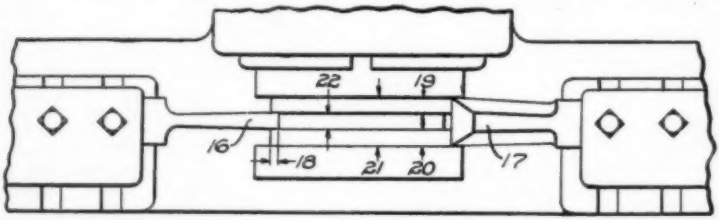
A blade which for maximum economy is sharpened on the front face only—

A blade with a top face formed throughout its length in such fashion as to eliminate in part or entirely, restriction of chip expansion—

A holder of a design which permits blade removal and replacement in minimum time and exact position and has all the rigidity of a solid forged tool when blade and holder are locked together.

In 1927 the first of the series of patents on Luers cutting off tools was granted. Let's see what they offer.

Side Clearance—In composite (sketch H) a Luers patented blade, section 23, is placed with a conventional beveled section 24, it will be readily observed from the sketch that to reproduce the same sufficient side clearance of the Luers blade 23, and without in-



SKETCH G.

Again YEARS AHEAD!

Tapping a two-hole job on a new Haskins Type C Tapper equipped with 8-station air operated dial-feed fixture. Automatic indexing under control of Haskins automatic air valve. Material—No. 11 gauge cold rolled steel. Size of tap—No. 8—32.

HASKINS TYPE C TAPPER "THINKS" FOR THE OPERATOR

Variable Human Element Replaced by Pneumatic Control!

NOW-all the operator has to do is depress the foot pedal air valve and load and unload the work. He *can't* go wrong. For the down stroke, return stroke and dwell at top of stroke are entirely controlled by air, and quickly adjusted for any job. Either in single or continuous cycle operation, this great new Haskins Tapper delivers the same *cushioned* pressure every time. Results are *uniform*—exactly the same at 4 P. M. as at 8 A. M! Production is *greatly* stepped up. Tolerances to suit the most exacting requirements are *easily* maintained. Tap breakage is *amazingly* reduced. The tap head action is so sensitive that if the tap dulls or loads, the machine refuses to work!

WRITE FOR FREE BOOKLET

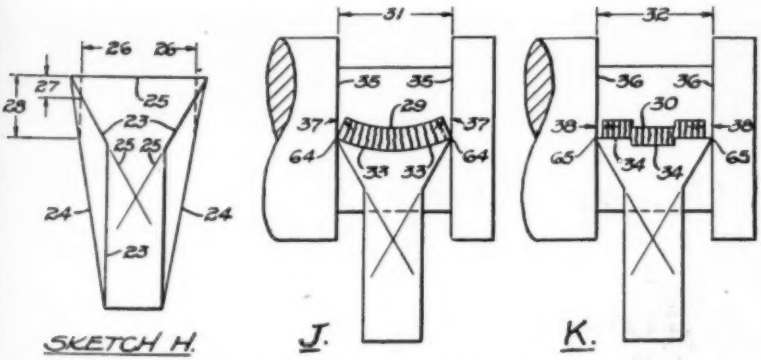
A long time in development, and now fully tested under all conditions, the Haskins Type C Tapper with *built-in* Air Control is available in three capacities. All models easily converted to use automatic air operated magazine-feed and dial-feed fixtures for high production schedules. Get *all* the money-saving, production-increasing facts. Write to R. G. Haskins Company, 623 S. California Ave., Chicago, for a new booklet which gives complete specifications and actual performance figures.

AIR Control

HASKINS

Precision

TAPPING EQUIPMENT



fringing on these patents, would result in a practically useless triangular section 25-25-25 (sketch H).

In further reference to (sketch D) and the flat or parallel sides 9-9 (sketch D) and 26-26 (sketch H) formed by wear on a cutting off tool, note the difference between the depth of flat 27 (sketch H) on the Luers section, and the depth of flat 28 (sketch H) on the beveled section caused by equal wear. That difference means just this:—The Luers blade 23 with the small side wear at 27 (sketch H) will continue to cut efficiently. The beveled blade 24 with the pronounced wear at 28 (sketch H) has completely lost its clearance and must be sharpened.

Sufficient side clearance throughout the length is emphasized as one important reason for the long tool life and greater cutting efficiency of the Luers design.

Luers blades are made with either parallel cutting edges or with back clearance throughout their length.

When sharpening is necessary they are ground on the front face only.

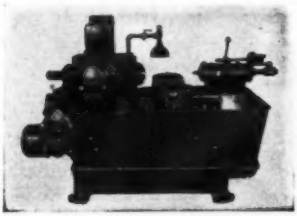
Restriction of chip expansion and the destructive resultant chip heat are greatly reduced by the Luers patented hollow or concave top blade section shown (sketch J) and the patented depressed center top section shown (sketch K). Also chip breakers are generally eliminated by means of these blade top forms, because the chip is not tightly packed by side wall restriction, and therefore of no great toughness or strength.

Chip 29 (sketch J) or 30 (sketch K) which is solid metal the width of cut off slot 31 (J) or 32 (K) as it is cut from the bar, instantly bursts as previously explained in reference (sketch A), in the same instant the side walls of the cut force the particles of the burst chip back into practically its original solid form, generating great frictional heat in the chip itself. This destructive additional heat is instantly conducted to the cutting lip of the tool.

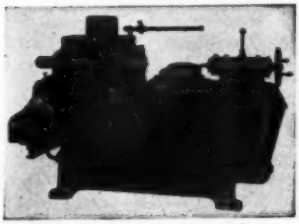
Side walls 35-35 (sketch J) or 36-36 (sketch K) formed by tool width 31 (J) or 32 (K) are still a barrier to chip 29 (J) or 30 (K) expansion, but the patented top form of Luers blades provide a cutting lip or width 33 (J) or 34 (K) which is wider or longer than the actual width of blade 31 (J) or 32 (K). And this irregularity or multiplicity of cutting edges formed longitudinally on the top face of Luers blades forms a depression 33-33 (J) or 34-34 (K) into which the chip 29 (J) or 30 (K) does collapse as it is cut from the solid mass or bar, thereby relieving the side wall pressure or restriction of expansion of chip 29 (J) or 30 (K) at 37-37 (J) or 38-38 (K) by side walls 35-35 (J) or 36-36 (K). and preserving the important outside

Sundstrand Speed Tools

for Accurate High Production



Model 8 Automatic Stub Lathe



Model 12 Automatic Stub Lathe

No. 2 Electromil

High accuracy, easy set-up, rapid operation, and exclusive advantages make Sundstrand Machine Tools outstanding for high production, fine finish, low cost. Investigate. Write, today, for complete information.

Automatic Stub Lathes 8"-10"-12"

Rigidmils

Rigidmil No. 0 with hydraulic feed, above; also made with hand feed. No. 1, hydraulic, at left. Larger sizes also.

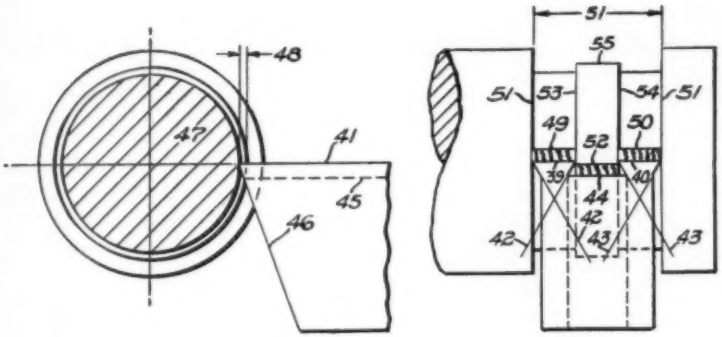
Tool Grinders

Save on sharpening; produce keen edges. Right, 2-wheel Grinder. Below, 3-wheel Grinder.

Sundstrand Machine Tool Co., 2535 Eleventh St., Rockford, Illinois, U. S. A.

RIGIDMILS - STUB LATHES

Tool Grinders - Drilling and Centering Machines
Hydraulic Operating Equipment - Special Machinery



SKETCH L.

cutting points 64-64 (J) or 65-65 (K) which in turn greatly prolongs the free and easy cutting action of the Luers blade.

Now for comparison refer back to (sketch G) and the description of the opposed blade cutting off machine.

The Luers patented top face or form shown in section (sketch L) formed by three blades or in solid form, provides two separate cutting off tools or lips 39-40-L on plane 41-L with sufficient side clearance at 42-43-L, combined with a center cutting tool or lip 44-L on a slightly lower plane 45-L. The angular face 46-L permits the outside tools or lips 39-40-L to penetrate the bar 47-L ahead of center tool or lip 44-L as at 48-L.

The tool is fed into the work, outside tools or lips 39-40 (Sketch L) penetrate the revolving bar 47-L to a depth of say .010 of an inch at 48-L cutting chips 49-50-L that depth 48-L forms no chip restricting walls, yet the operation would quickly form walls at 51-L width and 53-54-L were it not for center tool or lip 44-L cutting chip 52-L which follows through and right behind tools or lips 39-40-L as at 48-L continually cutting away annular band 55-L and walls 53-54-L formed by tools or lips 39-40-L.

Three separate and clean cut chips, 49-50 and 52-L are cut by this Luers patented tool or combination of tools or lips 39-40 and 44-L. Chips 49-50-L are free to expand to the center of cut 51-L. Chip 52-L is free to expand in either direction, eliminating the most destructive factor in cutting off, which is restriction of normal chip expansion.

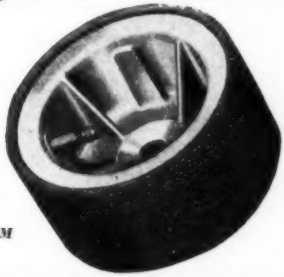
It is emphasized that the Luers blade (sketch L) cuts off with the same facility as the opposed blade single purpose cutting off machine, and for the same reason the chip is free to expand.

Composite (sketch M) shows various types of cutting off blade holders, in which the blade binding medium at line 56-56-M is located a certain distance 57-M from the rearmost exposed top face of the blade at 58-M. This distance 57-M represents unsecured blade extension, and consequential loss of blade rigidity. Split or other certain types of holders when new or in good condition bind the blade out to holder extremity 58-M, but generally after accidental blade breakage has occurred several times this clamp grip at 57-M is destroyed or distorted by the levering action 63-M of the broken blade end, and the binding line recedes to the actual or positive line 56-56-M.

Mall TRADE MARK

PNEUMATIC SANDING DRUMS

ADD EFFICIENCY AND ECONOMY TO ALL INDUSTRIAL FINISHING



MALL PNEUMATIC SANDING DRUM SIZE 3"x6"

ON AERIAL GRINDER

ON FLEXIBLE SHAFT MACHINE

ON BENCH GRINDER

The wide-spread use of this air-cushioned metal finishing wheel is convincing proof of its efficient and economical performance. It holds the abrasive firmly in place to provide a clean, even cutting action—free from chatter.

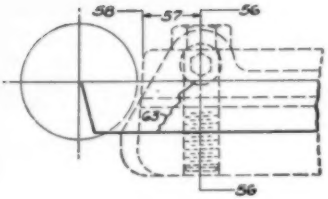
It leaves a fine draw file surface on all metals and other material in a minimum of time and with minimum effort. Its universal application to all models of flexible shaft machines, bench and aerial grinders, eliminates the need for special equipment.

The low cost of this all-purpose finishing tool is quickly absorbed in savings on time, labor and abrasives. Arrange TODAY to incorporate this MALL Pneumatic Sanding Drum into your production program.

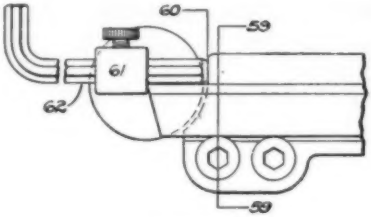
Complete information will be furnished on this tool and MALL flexible shaft grinders and portable power tools without cost or obligation.

MALL TOOL COMPANY

7742 SOUTH CHICAGO AVENUE CHICAGO, ILLINOIS



SKETCH M.



SKETCH N.

In the Luers blade holder shown in (sketch N), the lock is so positioned that the actual and very important binding line 59-59-N is practically at the forward extremity of the holder, and rearmost exposed top face of the blade at 60-N, and by this correct locking position or line, when the Luers blade shown in (sketch L) and holder shown in (sketch N) are locked together, the combination is claimed to have the rigidity of a solid forged tool of equal blade extension and to meet every cutting off tool requirement.

The adjustable collar 61-N on hexagon lock wrench 62-N is used to gauge the original blade extension, saving time when blade change is necessary.

*Pine St., Mt. Clements, Mich.

No. 35T SHARPENER

AUTOMATICALLY SHARPENS METAL SAWS IN GANGS

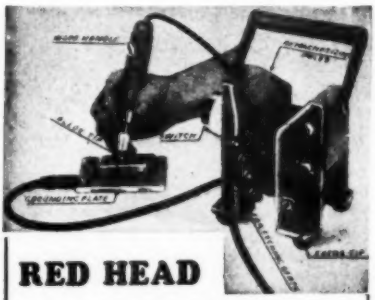
Up to 5½" diameter and up to 1¾" thickness. 100 SAWS of 26 GAUGE CAN BE SHARPENED AT ONE TIME.

The saws are automatically indexed and sharpened within a variation of plus or minus .001 of exact diameter of entire lot.

WRITE FOR CIRCULAR

The WARDWELL MFG. CO.

3165 FULTON RD. CLEVELAND, O.



RED HEAD

ETCHERS and DEMAGNETIZERS

Let us tell you the many advantages of our new D. C. and A. C. models now available. Also, see our new line of Magnetic Parallels and Midget Chucks.

Send TODAY for latest circulars

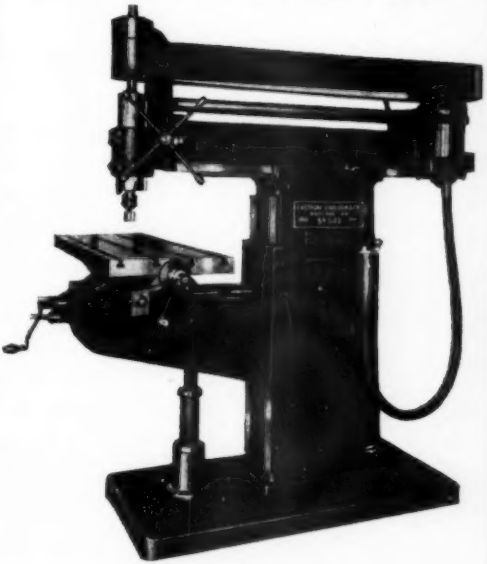
PRINTZ ELECTRIC CO.

14595 KENTUCKY AVE.,

DETROIT, MICHIGAN

A NEW UNIVERSAL MILLING, DRILLING AND ROUTING MACHINE— FOR CUTTING WOOD & METAL

- 8 DIFFERENT SPEEDS.
- 33" MAX. THROAT CLEARANCE.
- 24" VERTICAL ADJUSTMENT OF TABLE.
- 30" LONGITUDINAL ADJUSTMENT OF TABLE.
- 16" TRANSVERSE ADJUSTMENT OF TABLE.
- 8" TRAVEL OF THE SPINDLE.
- 90° TILTING SPINDLE IN BOTH DIRECTIONS.
- 30° TILTING TABLE.
- MICROMETER TABLE ADJUSTMENTS.
- EQUIPPED WITH SPINDLE LOCK & BRAKE.



USED IN:-

+ E. C. NO. 540 +

LARGE & SMALL PATTERN SHOPS!
IN AIRCRAFT FACTORIES!
IN METAL WORKING PLANTS!

WRITE FOR COMPLETE INFORMATION & PRICE.

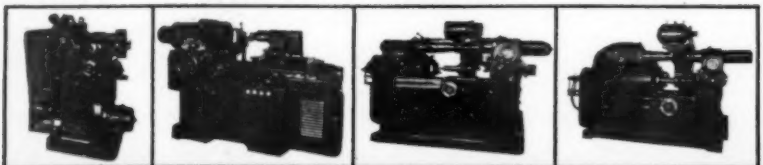
EKSTROM-CARLSON & CO.
ROCKFORD. Est. 1904 ILLINOIS, U.S.A.

BRYANT GRINDERS

THERE is a Bryant Grinder to meet every requirement of tool room work, small lot grinding, and high production work. The exclusive feature of BRYANT wheel head suspension is an outstanding asset when grinding straight, taper, a combination of straight and taper, or double taper holes in one operation, as well as curved, cam shaped, or blind holes. BRYANT Two-Spindle Grinders are a further asset in that the bore and face of the work may be ground concentric in one setting. BRYANT Grinders cover the complete range of internal and face grinding work — from tiny bearing races to large gears and cylinders. Send for catalogs.

FOR EVERY INTERNAL AND FACE GRINDING NEED

Series 5 | Series 112 | Series 16 | Series 24



BRYANT CHUCKING GRINDER CO., Springfield, Vt.

Standard Jig Applications

The First of a Series of Articles on Modern Jigs and Production Fixtures.

By E. J. McGarry, Chief Engineer,
Esco Eng. & Sales Co, Detroit

"STANDARDIZED" Jigs have been on the market for a number of years, but the full advantage of their time and money saving possibilities has not been appreciated by a great number of tool designers.

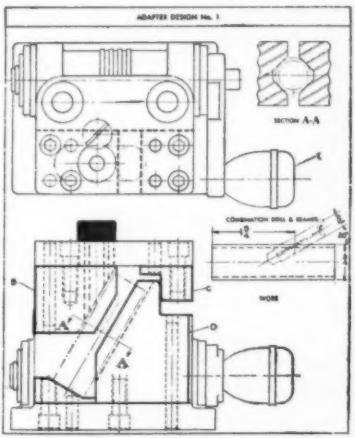
From a tool designer's viewpoint, the cost of a fixture and the production per hour of finished parts, are secondary. His chief concern is that the fixture he designs will produce parts as per blue print. In other words, he doesn't want the production foreman to suggest that: —"Well, at least it will make a good anchor for a boat."

The tool designer for a drilling machine manufacturer, however, is made acutely "Production Conscious" whenever a multiple setup is used with an index table. Under such circumstances, the machine cycle is divided into, roughly speaking, machining time and loading time. And the tool designer must strive to make the loading time less than the machining time in order to get the maximum production from the machine.

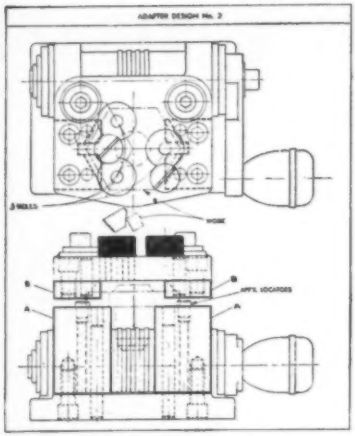
In a single or multiple spindle setup, without an index table, where the machining time cannot overlap the loading time, it is equally important, from a production standpoint, that the loading time be held to a minimum. However, in such instances, the proportionate loading time is not so readily apparent unless a time study is made.

The speed and feed of any drill being a fixed factor, the only variable in attaining maximum production, then, is the loading time of the fixture. By taking advantage of the "standardized" fixtures now available, this, too, becomes a fixed factor. Depending on the size of the work, this factor should be proportionately between one and one-half (1½) to six (6) seconds.

The design of the adapter, therefore, must provide for automatically locating the work properly so that no ingenuity is required on the part of the operator other than to lower the bushing plate to the work; automatic clamping of the work being a function already provided and built into the "standard" fixture.

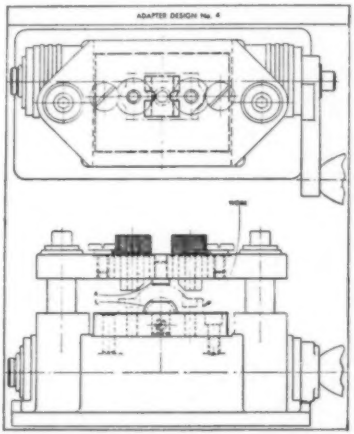


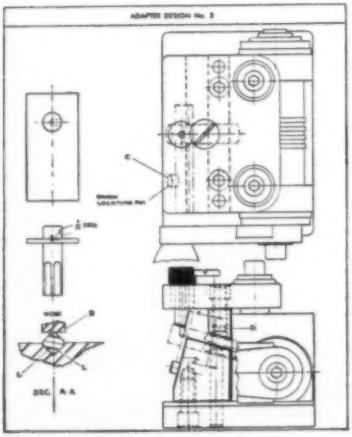
In this article and in others to follow, it is my intention to attempt to



describe the design of "Adapters" for various parts, which are now in successful operation.

Design No 1—This example shows a brass tube with a hole drilled and reamed to 5/16" diameter at an angle of 30-degrees to its centerline. A 4-fluted combination drill and end-cutting reamer is used, two lips being ground from the reamer to form a flat drill. The drill throws a burr up on the outside of the work but most of this is removed by the reamer, leaving the outside and inside of the work almost free from burrs. The work is clamped between two Vee-blocks as shown in section A. A. When the bushing plate and Adapter "B" are clamped against the work, any tendency for misalignment is prevented by the heel block "C" which is hooked over the lower Vee-block "D." The bushing plate and upper adapter are raised from the work by the handle "E," providing



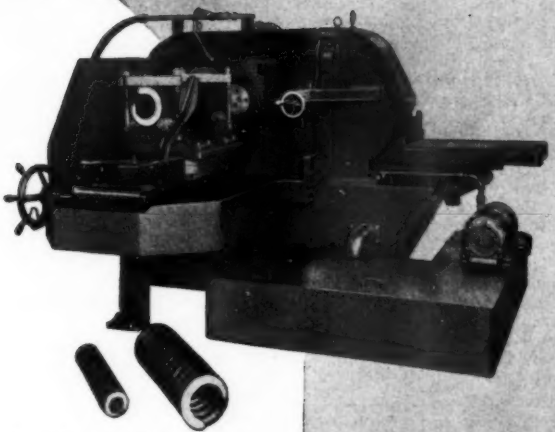


ample clearance to get the work in and out of the fixture.

Design No. 2—In example No. 2, three holes are being drilled in the hexagon shaped flange of the work. Rest blocks "A" at each side of the work are arranged also to provide clearance for the body of this work. The angular faces on the clamping blocks "B" accurately locate the work when lowered by the operating handle.

Design No. 3—Another example of drilling an angular hole is shown in Design No. 3. Locating points of the work are shown at "L" in the sketch,

A "husky" 30" surface grinder for really TOUGH jobs!



MANY a heavy-duty job can be handled on the Gardner No. 96—30" Traveling-Head Hydraulic Surface Grinder illustrated here.

This machine weighs almost 6 tons, carries a 30" diameter x 2" or 3" thick abrasive wheel, mounted on a 5⅞" diameter spindle, and, for the springs which you see, is powered by a 50 H.P. motor.

The large coil springs visible, measure 9" O.D. x 31" long x 1¾" wire, and they are ground at the rate of 1½ to 2 minutes per end, removing as much as 5/16" stock from each surface.

Grinding the feet of large motor frames is another job handled on this "husky" tool; in fact, it has almost unlimited possibilities on heavy work.

Write for full details—or ask for your copy of our 24-page booklet—
"MODERN METHODS of GARDNER GRINDING."

HEAVY-DUTY GARDNER WIRE-LOKT ABRASIVES HELP "LICK" THESE TOUGH JOBS!

GARDNER MACHINE COMPANY

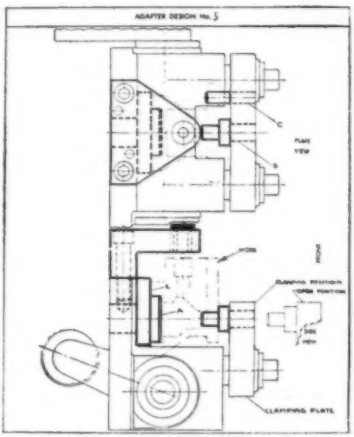
436 East Gardner Street . . . . . Beloit, Wisconsin, U. S. A.

and the work is clamped into the Vee-block by "B." A rough locating pin is provided at "C" which holds the work in approximate position until clamped.

Design No. 4—This example shows the adapter for drilling and counterboring a cable clamp. The locator in this case is on the lower wear plate, and the part is clamped by the button "A." Slip bushings are provided which are removed to allow clearance for the piloted counterbore through the liner bushing.

Design No. 5—In design No. 5, the fixture is being used at 90-Degrees from its normal position. In other words, the plate that is usually used as a combination bushing plate and clamping plate is being used only for clamping. The bushing plate is attached to what is normally called the base of the jig. The operation consists of drilling and counterboring a hole at right angles to three previously drilled holes. The part is located over plug "A" and clamped against face "L." Outer support is provided by plug "B" and radial alignment by pin "C."

This discussion will be continued in additional articles in the near future. If you have any jig or fixture problems along this line, send them in for helpful recommendations, which will be offered without any obligation on your part.



If you have worked out a jig problem of this kind to your own satisfaction, send in the details with a rough sketch. We will pay space rates for all such items accepted for publication.

Just What You Have Been Wanting—An Economical Live Ball and Roller Bearing Center.

For Lathes, Hand Screw Machines, Grinders, and Mills

1. Simplicity and sturdiness adapt this center to heavy duty with extra long life.
2. Sufficient bearings for radial, thrust, and alignment loads resulting in 50% more radial load than the average live center.
3. Large spindle, small head, and short overhang spells rigidity—result, no chatter.
4. Has special oil seal to retain lubricant and resist foreign matter.

A folder giving prices and complete detail will be mailed to you just for the asking.

A lower first and last cost. Let us prove it by sending you one today for a ten day trial, and if not satisfactory in every way return it.

MOTOR TOOL MFG. CO.
12281 Turner Ave., Detroit, Mich.

EVERY PLANT NEEDS ONE

WODACK "DO-ALL" ELECTRIC HAMMER

and Electric Drill Combined. Drills holes in concrete and masonry for expansion bolts up to 1⅜" diameter and 24" depth. Also chips and chisels concrete. Quickly changed to electric drill for drilling metal up to ⅜". Two models, $88.50 and $98.50. Two tools for the price of one. Sold on approval. Write for Bulletin 400.

Wodack Electric Tool Corp.
4629 W. Huron St., Chicago, Illinois

Weight 6½ lbs.

WE WANT TO PROVE THE EASY WAY—

Saves Up To 80% In Time-Labor-Abrasives

Speeds Up Production

Produces A More Uniform Finish

Earns Extra Profits

THE *Easy* ELECTRIC SANDER

Operates From Any Electric Outlet

FOR NEW OR MAINTENANCE WORK—sanding, rubbing or polishing . . . on flat, curved or irregular surfaces . . . wood, metal, bakelite, slate, leather, plastics, or composition materials . . . filler or sealer coats, shellac, varnish, lacquer, enamel and other finishes. . . the EASY Sander does the job much faster and produces a more uniform finish with less physical effort than is possible by hand or other methods.

MACHINE TOOL MANUFACTURERS

The EASY can't be beat for sanding filler (plaster) coats. Let us prove it the hard way—in your plant—on your product—with your own operators—that the EASY is all we claim.

Write for details today.

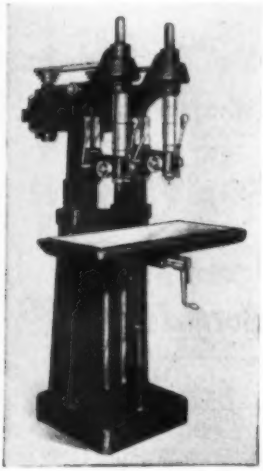
Reciprocating action of the EASY mechanically duplicates the back and forth motion of hand work.

A PRODUCT OF THE

DETROIT SURFACING MACHINE CO.

7432 W. DAVISON, DETROIT, MICHIGAN

Your Drill Hands might give you a tip



If you ask your drill hands what they think of Buffalo Drills, you may get an enthusiastic vote for them. Experienced operators have found that Buffalo Drills were designed to make operation easy. Controls are placed so that minimum effort is required to operate them. Accuracy beyond your expectation. Power assures a high production rate.

Buffalo builds complete lines of drills, from the 12-inch High Speed to the 22-inch Heavy Duty. Write for bulletins covering the models in which you are interested, and list of users.

BUFFALO FORGE COMPANY

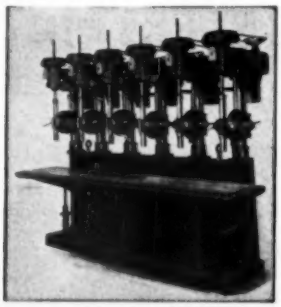
161 Mortimer St., Buffalo, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

15' Bench Drill

14' Two Spindle Drill

16' Six Spindle Drill

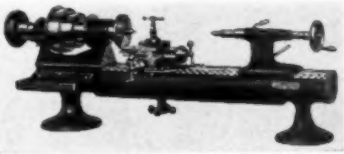


"Buffalo" **Single and Multi-Spindle Power Drills**

HARDINGE BROTHERS' GOLDEN ANNIVERSARY

1890 to 1940—50 Years of Progress in the Manufacture of Precision Machine Tools and Collets

TWO brothers, Henry and Franklin Hardinge, started a business together to manufacture watchmaker's lathes and collets in 1890. Their first factory was a crude building, just eight by eight in the rear of a boarding house at 359 West Monroe St., Chicago, Ill. After a few months, severe cold weather literally drove them out of the inadequate quarters and they formed a corporation with Stephen Dale, who assisted financially.



One of the earlier model bench lathes.

The next factory was a room over a horse stable at 1230 Dunning St., (now Altgeld St.,) in Chicago. Here the business grew to such an extent that it was then that in May, 1892, a small factory was erected at 3135 Lincoln Ave.

A modern Hardinge high speed precision lathe unit.

In 1894, Stephen Dale left Chicago and withdrew from the business. The Hardinge brothers conducted the business until 1895, when Henry Hardinge withdrew from active participation.

Franklin Hardinge carried on and the watchmaker's line developed into precision bench lathes and collets, and in 1913 the company moved into a modern fireproof structure in Ravenswood. Operations were carried on at that location until 1931, when new interests joined the Company and the business moved to a new modern plant in Elmira, New York. At this time, owing to advancing years, Franklin Hardinge became Chairman of the Board of Directors and Douglas G. Anderson was elected President.

During the entire 50 years of the company's existence, the insistence of Franklin Hardinge on the highest possible precision has resulted in the company's product being recognized throughout the world as an outstanding line in its field.

In 1937 and in 1939, new additions to the company's plant were made nec-

Hardinge high speed second operation machine of modern design.

essary by the rapidly expanding demand for Hardinge precision machines, tools and collets.

In 1938 the Morrison Machine Prod-

One of Hardinge's modern high speed tool room lathes.

ucts, manufacturers of collets, feed fingers and ground form tools for all makes of screw machines, was acquired and is now operated as the Morrison Machine Products Division.

The progress of machine tool design in the 50 year period is well illustrated by the improvements embodied in Hardinge products, resulting in the present Hardinge Modern Enclosed Head Preloaded Ball Bearing machines, which are capable of meeting present day requirements for accuracy, ruggedness, high speed, and ease of operation.

Hardinge Brothers, Inc., pioneered in the manufacture of precision bench lathes and milling machines using enclosed head Preloaded Ball Bearing construction and have been leaders in this field.

Hardinge Brothers, Inc. introduced individual driving units for bench lathes and today this is carried further by their introduction of Bench Lathes, Milling Machines, Screw Cutting Lathes and Second Operation Machines mounted on steel pedestals.

A late type Hardinge high speed milling machine.

This construction is now receiving general acceptance by the trade.

In 1935, Hardinge introduced a High Speed Precision Screw Cutting Tool Room Lathe, which has been widely adopted and used.

The collet line developed to such an extent that Hardinge became a source for all types of collets used with lathes and milling machines of any make. With the addition of the Morrison Machine Products Division, collets, feed fingers and form tools are supplied for any machine regardless of type or size.

The present plant illustrated embodies 50,000 square feet of modern manufacturing space and is devoted exclusively to the manufacture of precision products. The use of new and modern machine tool equipment in the Hardinge plant has kept pace with the needs for precision in present day manufacturing.

MARKED - IDENTIFIED

Permanently

MODEL 25

PART NUMBERS, CATALOG NUMBERS,
HEAT NUMBERS, SERIAL NUMBERS,
PATENT NUMBERS
MANUFACTURER—INSTRUCTION DATA—INSPECTION

Positive, Permanent MARKING ON YOUR PRODUCTS ASSIST PROSPECTS TO ORDER. MAKES IT EASIER TO BUY—NEW, REPEATS AND REPAIRS. GIVES YOU A DEFINITE RECORD OF PERTINENT DATA ON EACH PART PRODUCED.

The Pneumatic Marking Machine ILLUSTRATED IS OUR HI-DUTY MODEL 25 GENERAL PURPOSE TOOL FOR SHORT RUNS OR PRODUCTION WORK. IT OPERATES FROM YOUR SHOP AIR LINE AND IS ONE OF NUMEROUS MODELS BUILT TO PRODUCE NEAT, PERMANENT MARKINGS QUICKLY ON METAL FABRICATIONS.

WE WILL BE HAPPY TO MAKE SPECIFIC RECOMMENDATIONS UPON RECEIPT OF SAMPLES OR PRINTS OF PARTS TO BE MARKED, SHOWING APPROXIMATE LETTERING, ITS LOCATION ON THE PART, WITH REQUIRED HOURLY PRODUCTION.

MARKED PARTS ADVERTISE
IN THE RIGHT PLACE, AT THE RIGHT TIME.

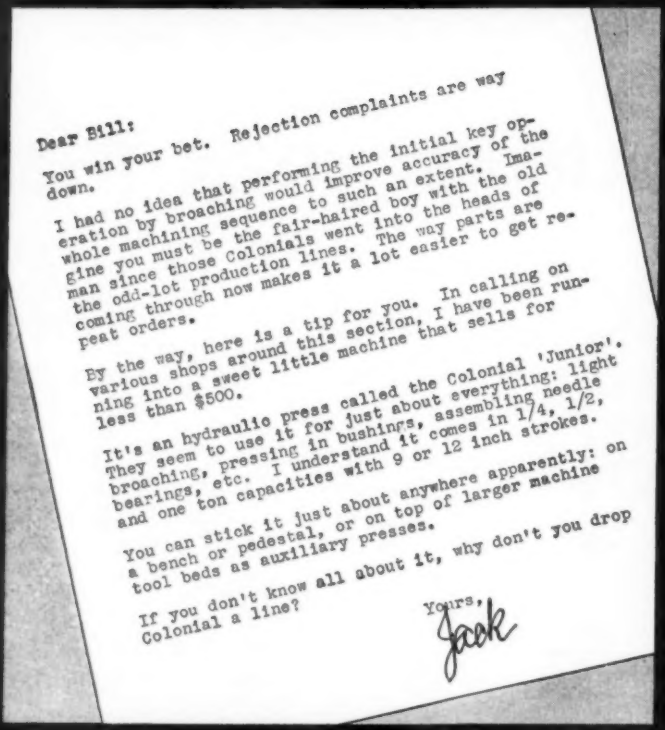
Unlike John Alden ——
"They Speak For Themselves."

Send for complete catalog of our full line of marking Tools, Machinery and Equipment.

GEO. T. SCHMIDT, Inc.

1802 Belle Plaine Ave., Chicago, Ill.
Builders of Marking Equipment Since 1895.

a Salesman's tip—



Dear Bill:

You win your bet. Rejection complaints are way down.

I had no idea that performing the initial key operation by broaching would improve accuracy of the whole machining sequence to such an extent. Imagine you must be the fair-haired boy with the old man since those Colonials went into the heads of the odd-lot production lines. The way parts are coming through now makes it a lot easier to get repeat orders.

By the way, here is a tip for you. In calling on various shops around this section, I have been running into a sweet little machine that sells for less than $500.

It's an hydraulic press called the Colonial 'Junior'. They seem to use it for just about everything: light broaching, pressing in bushings, assembling needle bearings, etc. I understand it comes in 1/4, 1/2, and one ton capacities with 9 or 12 inch strokes.

You can stick it just about anywhere apparently: on a bench or pedestal, or on top of larger machine tool beds as auxiliary presses.

If you don't know all about it, why don't you drop Colonial a line?

Yours,
Jack

— *about* **Broaching**

COLONIAL BROACH COMPANY 147 JOS. CAMPAU DETROIT, MICHIGAN

SOLVING Inspection Problems By PROJECTION

By

John W. King
Jones & Lamson Machine Company

(This is the second in a series of three articles on Projection Inspection. The first article of the series appeared in the January issue.

THE EXTREME precision with which distances and angles can be determined by projection plays an especially important part. Pieces can be checked to definite specifications or tolerances, and any variation from one piece to the next is shown on the screen. On production work, the tool wear, hardening distortion, and many other important details are studied which cannot be measured definitely by other means. For instance, checking an occasional piece by projection, as pieces are being produced with a forming tool, will not only show if the

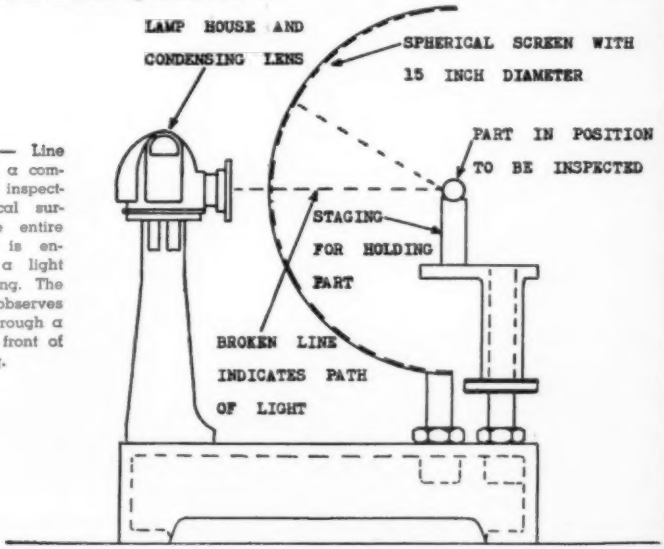


Fig. 1 — Line drawing of a comparator for inspecting spherical surfaces. The entire instrument is enclosed in a light proof housing. The operator observes the work through a slot in the front of the housing.

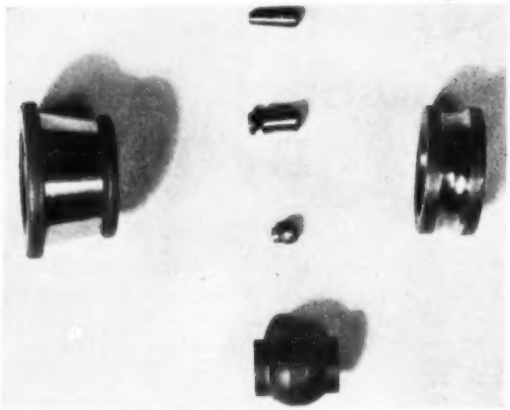


Fig. 2—A group of typical bearings and bearing races which are easily inspected by the projection method.

particular piece measures up to standard, but the amount of tool wear can be determined at the same time. That is because the radius of a second piece will be larger than the first piece by an amount equal to the tool wear, since the first of the two pieces was turned. (Provided, of course, the tool setting has not been changed). Since projection is a precision measuring method, the amount of tool wear is determined very accurately. Piston rings with ridges on their outside diameters can be cited as an example of one of many cases where both the product and forming tool are inspected by projection. (Valuable facts about how the extreme accuracy of projection keeps manufacturing costs at a minimum, especially on products turned with forming tools will be given in the conclusion of the last article in this series.)

For years projection comparators have been important factors in the development of today's accurate ball bearings. Not only is projection used to inspect the form tools and gages for producing the bearing races, but the inner bearing races are inspected by projection, after grinding, to determine their finish and shape. The most recent development of projection inspection used for inspecting balls used in bearings, is the newly developed

Fig. 3—A comparator used in drilling holes, in proper relationship, in plates for multi-color printing.

PERFORMANCE CAN'T BE FAKED

Easy Engagement
Instant Release
Dragfree Idling
Abundance of Power

are Conway characteristics you should know about

When a clutch goes in and out of action with the ease, smoothness and dependability of a Conway Clutch, you just know it's "there"—performance like that can't be faked or simulated.

That's why Conways are getting the call wherever machine design is in shrewd hands—transmission costs watched. They're the last word in friction clutches.

"The Conway Disc is a splendid clutch"

* * * * * *

Patented in U. S. and Canada.

* * * * * *

THE CONWAY CLUTCH CO.

1541 QUEEN CITY AVE.

CINCINNATI, OHIO

Ask us for catalog P-24, L-28 and XYZ-L.

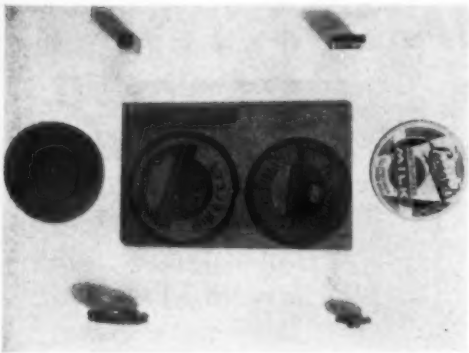


Fig. 4 — Milk bottle cap, printing plates, and samples of type which are easily inspected by reflection.

comparator for inspecting the smoothness of spherical surfaces. It is difficult, if not impossible to get a true picture of sizes and shapes of imperfections on spherical surfaces with a microscope, or other available means. This problem is solved with projection by reflecting the surface of the ball onto a spherical screen. In this way the actual nature of a spherical surface is ascertained easily. Figure 2 shows the principal parts which make up this comparator. The whole instrument is enclosed in a light proof housing, with a slot through which the operator looks when inspecting a part Since this instrument has a 15" spherical screen, the surface of a ¼" sphere is magnified 60 times.

Another interesting application of projection inspection is in multi-color printing. In printing milk bottle caps for example, different printing plates are used for the different colored inks. Formerly it was difficult to register all the plates so none of the colors would overlap in the wrong places. This problem was solved with a specially designed comparator shown in Figure 3. (A three spindle drill press is built into the machine for drilling dowel pin holes in the backs of the plates). The engraver marks two small crosses on the surface of a printing plate. These

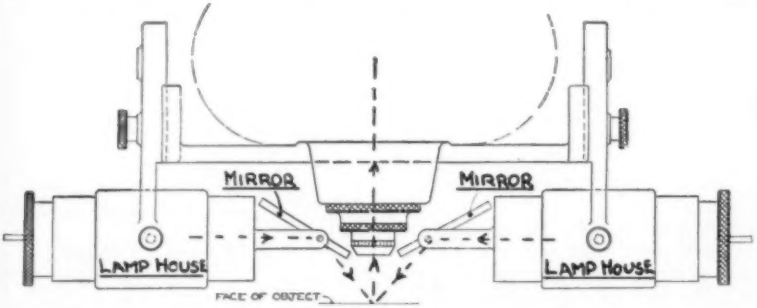
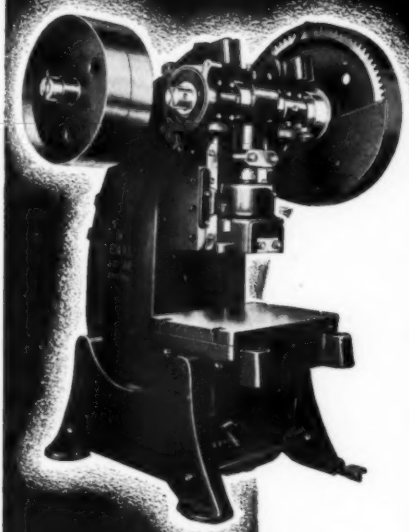


Fig. 5—Line drawing showing the principal parts of a reflection attachment used on a projection comparator. This attachment makes it possible to project an enlarged image of a surface onto the screen, instead of just the outline of the piece, as is usually the case. The broken lines indicate the path of the light.

Point by Point FEDERAL PRESSES STAND OUT



1. One-third Longer V-Ways. More accurate work.
2. Timkenized Flywheels. Roller bearings cut friction-maintenance cost.
3. Safety Latch-Spring. Eliminates die setting hazard.
4. Front Operated Recline. One man quickly and safely adjusts press.
5. Longer Crankshaft Bearings. Split vertically—frame supported.
6. Non-Repeat Clutch Mechanism. A patented safety feature.
7. Precision Built Throughout. .0015 inch tolerance on ram action.

"Built for Service"

TIMKEN BEARING EQUIPPED

These features mean lower production costs in Federal equipped plants. Check Federal before you buy presses. There's a Federal Dealer near you.

FEDERAL PRESS CO. ELKHART, IND.

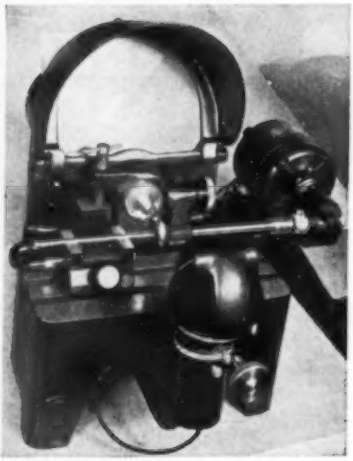


Fig. 6—Set-up for inspecting the concentricity and seat angles of valves.

crosses are marked in definite relation to similar crosses on the plates for printing the other colors on a given milk bottle cap. Then the two crosses on a given cap are reflected onto the comparator screen at a suitable magnification. The screen has two crosses drawn on it to proper scale. When the reflected crosses of the printing plate coincide with the crosses on the screen, the milk bottle printing plate is in proper position for drilling the dowel pin holes which will position the plate in the printing press. In this way the printer is assured that the various colors will be superimposed properly when the plates are used.

Reflection is used a great deal to measure surfaces such as type faces, punches, stamps, etc., which cannot be projected. (See Figure 5). With the face of the object located in the focal plane before the lens, beams of light reflected from the two lamp houses illuminate the surface to be inspected. The brightly illuminated face of the objects reflects through the projection lens, and casts on the screen an enlarged view of the reflected surface.

Small shafts, automobile and airplane valves, dental burrs, and the like require that the run-out of their shafts be within acceptable limits. By mounting such parts on the comparator work table in front of the lens, their enlarged outline is cast on the screen. Then by rotating the part about the axis through the center of its shaft, the amount of run-out can be determined. Usually lines are drawn on the screen indicating the maximum allowable run-out. If the shadow of the stem goes above this maximum tolerance line when the shaft is rotated, it is not acceptable, otherwise it is within

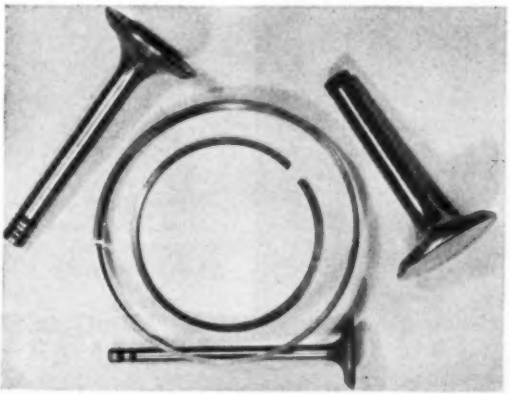
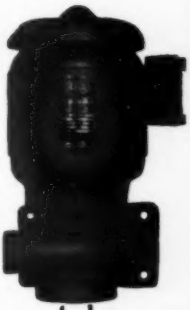


Fig. 7—Projection greatly facilitates the inspection of the typical valves and piston rings shown in this group.

TRADE MARK
FULFLO
REG. U. S. PAT. OFF.

CENTRIFUGAL COOLANT PUMPS AND BY-PASS OIL RELIEF VALVES

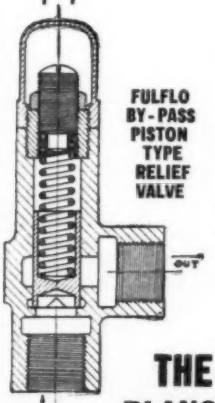


Symbol FVM Vertical Type

Compact and efficient new coolant pumps designed to handle coolant containing chips and abrasive material. There is no packing to wear. A short motor shaft extension drives the free floating impeller. A special patented seal seats against the pump housing, leaving motor shaft free from wear. Coolant can be throttled down or shut off while motor is running without injury to pump or motor. The Master motors are of the ball bearing splash-proof type.

Symbol FHM Horizontal Type

Pump discharge is 1". Horizontal unit is tapped for 1¼" suction pipe. Mounting flange permits bolting vertical pump to side of tank or machine. At 1725 r.p.m., with 1" pipe and a 5' head these pumps will deliver 30 gallons per minute. With a 1" nipple and 1¼" hose on discharge they will deliver 45 gallons per minute at a 5' head.



FULFLO BY-PASS PISTON TYPE RELIEF VALVE

FULFLO BY-PASS PISTON TYPE OIL RELIEF VALVES are available in cast iron or bronze, with pipe sizes from ¼" to 1½", for pressures up to 350 lbs. May be equipped with brass, hardened steel or stainless steel pistons.

May we send you complete information on the FULFLO Line?

THE FULFLO SPECIALTIES CO., INC.

BLANCHESTER OHIO

Now Available

3 NEW

BODY SIZES OF PRESS FIT BUSHINGS CONFORMING TO LATEST A. S. A. REQUIREMENTS.

Three new sizes now complete the standard line of Universal quality drill bushings. All Universals have rust proof black domes and superfinished bores assuring concentricity and unexcelled wearing qualities. Write for facts.

UNIVERSAL
Engineering Company
Frankenmuth, Mich.

acceptable tolerances. On some such jobs, a small motor is attached to the comparator work table to rotate the piece. (See Figure 6). The motor increases the number of pieces which can be inspected per hour, which is usually several hundred.

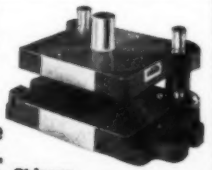
These are but a few unusual applications of projection inspection. In many cases the utter simplicity and quickness alone, with which difficult inspection problems are solved make them unusual. (More applications of projection inspection will be given in the next article of this series which will appear in an early issue.)

Turner Improves Metal Spray Gun

Improved design and construction in this industrial metal spray gun includes enclosed air tube to spray nozzle and screw type crucible cover set at a 45 degree angle. Passing the air tube inside the burner shield preheats air used in atomizing the spray and thus overcomes freezing metal in spray nozzle throughout the complete spraying range of 8 oz. to 2 pounds of metal per minute. The crucible cover, set at a 45 degree angle, permits forward tilting of entire unit for spraying horizontal surfaces without spilling molten metal from crucible. The opening in crucible cover accommodates any standard rod or bar solder. Any of the tin-lead alloys are handled equally well by simple adjustments of the controls.

Address The Turner Brass Works, Sycamore, Ill., for further details.

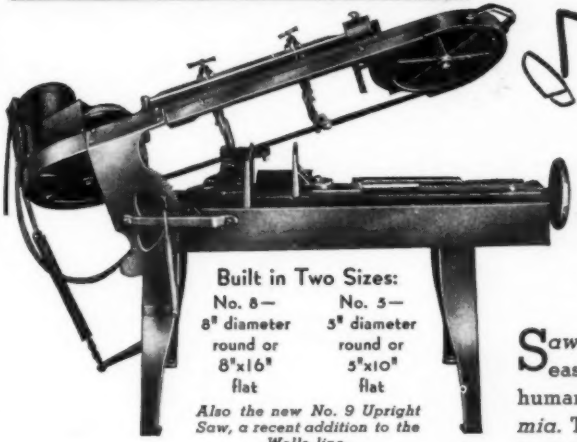
DANLY
DIE SETS
Precision
Commercial
Special



Danly Machine Specialties Inc.
2130 S. 52 Avenue, Chicago

DANLY DIE MAKERS' SUPPLIES

Has your plant SAWITIS?



Built in Two Sizes:

No. 8—	No. 5—
8" diameter round or 8"x16" flat	5" diameter round or 5"x10" flat

Also the new No. 9 Upright Saw, a recent addition to the Wells line.

Sawitis is a plant disease similar to the human ailment: *Anaemia.* The symptoms are: loss of production line "pep," frequent bottlenecks due to cut-off room breakdowns, and high stock mortality rates because of inaccurate metal cutting. One or all of these symptoms will cause high blood pressure in the cost department. The recommended remedy is Wells Saws. Their fast accurate cutting and dependable service backed by years of saw-building experience will cure the most tenacious case of *Sawitis.* Sold through leading Mill Supply Dealers—or write direct.

WELLS MFG. CORP.

WELLS METAL CUTTING BAND SAWS

THREE RIVERS, MICH.

MARSHALLTOWN

DESIGNED AND BUILT PRESSES GIVE *BETTER* PRODUCTION AND *LONGER* LIFE

No. 5 FLYWHEEL TYPE

The Marshalltown Line includes inclinable presses from 5 to 70 ton capacity.

Features of design include more die space, chrome nickel cranks, wrist pin connections and many other proven elements of correct design. Literature fully describing this sturdy, dependable line of presses will be sent on request. It will pay you to investigate.

MARSHALLTOWN MFG. CO.

900 East Nevada Street, Marshalltown, Iowa

BROACHING

Reinforced Babbit Bearings

THE SB-48-4-ton single ram surface broaching machine illustrated, was furnished to a prominent manufacturer of bearings for splitting off the top waste and rough broaching the inside diameter of steel reinforced babbit automotive crankshaft bearing halves.

The work arrives at this machine as a rough die casting long enough to make three bearings when sawn apart in a subsequent operation. Figure I illustrates the first or splitting operation showing the stock removed by broaching, while figure II illustrates the second or ID broaching operation.

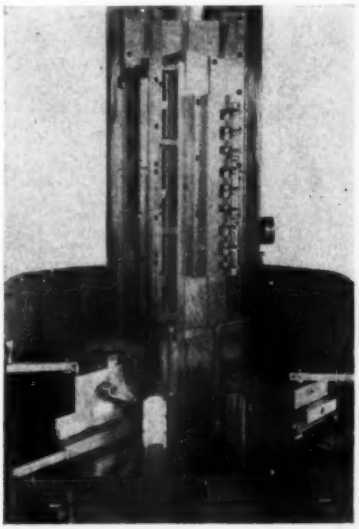
Because most of the cut is babbit, with only a small portion steel, the machine is arranged with a broaching speed of 64 feet per minute and a return speed of 120 feet per minute. This insures smooth cutting of the babbit and provides a very high production.

Two independent hydraulically receding work tables and electrical controls are interlocked so that when the "Start Cycle" push button on one side of the machine is pressed, the work table on that side automatically advances to broaching position, the ram descends, broaching the work, the table recedes to loading position and the ram returns to the top of its stroke. During this time, the operator has been loading the fixture on the other work table and now presses the corresponding "Start Cycle" push button to repeat the cycle on that side. Safety interlocks provide that neither work table can advance until the ram reaches the top of its stroke, nor when the other table is in broaching position.

This arrangement, for which patents have been applied, permits the use of the entire machine cycle for loading, and can be used advantageously for surface broaching operations requiring little cutting and ram return time and where a high production is desired.

The tooling is shown in the illustration, also a rough piece on the left as received at the machine, and a finished piece at the right after the two operations have been performed.

The machine is of typical "American" design wherein the "ram" or cylinder, slides in hardened and ground



CHICAGO

STEP PULLEYS

SINGLE GROOVED PULLEYS

VARIABLE PITCH PULLEYS

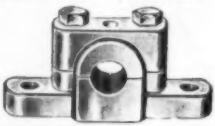
MULTIPLE DRIVE PULLEYS

FLEXIBLE COUPLINGS

HAND WHEELS

FLANGED PULLEYS

SELF-ALIGNING SHAFT SUPPORTS



MANUFACTURED AND STOCKED BY

CHICAGO DIE CASTING MFG. CO.

2502 W. Monroe St., Chicago, Ill.

CATALOG ON REQUEST

box type ways on generously proportioned guides cast integral with itself, and all the moving parts are provided with pressure type automatic lubrication. The hydraulic pump and electrical control equipment are concealed in the column with all points of replacement and adjustment easily accessible through a door secured with a quick-acting latch. A coolant pump

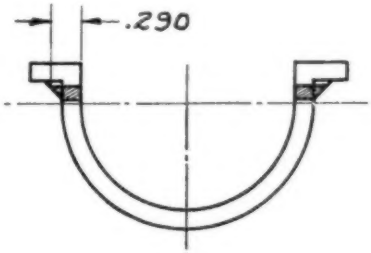


FIGURE I

of ample capacity and a fan type pressure gage are supplied as standard equipment.

Length of cut is 6 1/32" and length of stroke 48".

Production obtained is 232 complete pieces per hour at 100% efficiency.

The machine was made by American Broach & Machine Co., Division of Sundstrand Machine Tool Co., Ann Arbor, Mich.

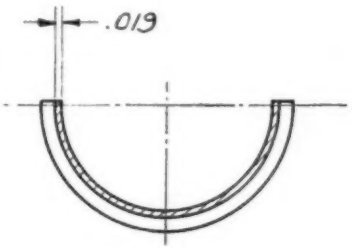
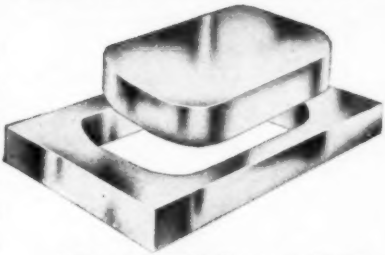


FIGURE II

SAVED $43 MAKING THIS PUNCH

Capitol Products Co., of Winsted, Conn., made this punch for base of electric toaster from 2" thick Paragon Tool Steel. The DoAll produced it in 2 hours and 20 minutes. Accuracy from outside to bottom, within .003".



They estimate these savings:

17 hours, 40 minutes..... **$28.00**
25 pounds of steel **15.00**

STARTLING RESULTS

Contour Sawing, the new DoAll process of machining, is recognized as the fastest precision method of removing metal; cuts out internal and external shapes from any metal up to 10" thick.

Does work of 3 machines. DoAll is a moderately priced, rugged, precision machine tool that replaces shaping, milling and lathe work on a large variety of jobs with enormous savings.

Used in large and small plants in 30 countries, by such firms as Cadillac, Fisher Body, Baldwin Locomotive, Federal Cartridge, New Monarch Machine, L. S. Hafkins, Edison Industries, Wayne Pump, U. S. Navy, etc.

DO-ALL
Contour Machines
BAND SAWING
BAND FILING
BAND POLISHING

Let a factory trained man bring a DoAll to your plant and show you what it does, what it saves on your own work.

H-2

☐ Send data on the DoAll.
☐ Send Free Hand Book.

FREE—New Handbook on Contour Machining——158 pages of valuable metal working helps.

CONTINENTAL MACHINES, INC.
1300 S. Washington Ave., Minneapolis, Minn.

Name.....

Address.....

A Distinctively New Catalog!

USE THE COUPON TODAY AND
GET YOUR COPY

● **Our new and completely modern Accessories Catalog is just off the press. It is designed to be of maximum usefulness and convenience to every tool room and die and mold shop. It illustrates and describes new double end mills and holders; new jig boring bars and boring heads; new circular tables in three sizes; new machine lamps; and many other useful tools.**

MAIL TODAY

George Gorton Machine Company
1115 13th Street, Racine, Wisconsin

Date.....

Please send me at once your new Accessories Catalog.

Name.....Position.....

Firm Name.....

Street Address.....

City.....State.....

GORTON

GEORGE GORTON MACHINE CO.
1115 13TH STREET, RACINE, WISCONSIN, U. S. A.

What's New in the Industry

Moore Jig Grinder

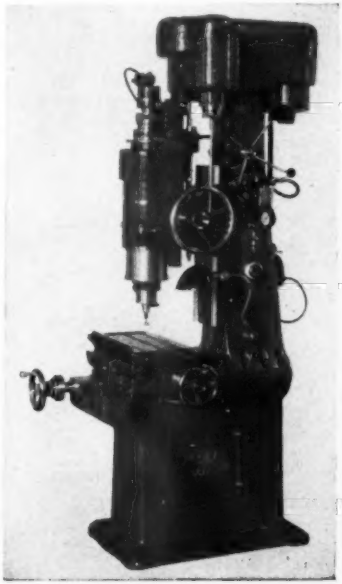
The Moore Special Tool Co., Inc., Bridgeport, Conn., offer a new toolroom machine which they call a Jig Grinder, due to its similarity, in principle, to the Jig Borer.

The machine is designed primarily to correct the location of holes in hardened steel parts, jig, master plates, gauge parts, etc. In precision - compound, and progressive die-work, holes often must be spaced within an accuracy of .0005" or less. The distortion from hardening, however, is too great to assure such close limits without grinding after hardening. The makers point out that until now, home-made devices have been used to do this correcting operation and the new grinder is offered to correct such distortion scientifically by using the measuring sytem of the Moore Jig Borer. In this manner, it is emphasized that holes in hardened steel can be located within limits, in size and particularly in location, which heretofore have been thought impossible.

Base and compound table are the same as on the borer, but all table ways and slides are well protected from emery dust by removable guards.

Upper parts of machine consists of a column upon which is mounted, in double V-ways, the spindle head which takes the place of the corresponding part with boring spindle of the Jig Borer. The top housing contains the motor and variable-speed drives for both speeds and feeds. The infinite speed control covers a speed range of from 50 to 150 r.p.m. and the infinite feed control a feed range of from .004" to .020" per spindle revolution.

The main spindle consists of a large sleeve mounted on two pre-loaded precision ball bearings, 6½" in diameter. Inside this sleeve is mounted the vertical slide carefully fitted into slide ways, pivoted at the bottom, allowing vertical slide to swing from the vertical position up to a maximum of 1½° either way. Tapered holes, as for example piercing holes with draft, can be ground, up to a length of travel of 3⅝".



Lower end of vertical slide carries a cross slide upon which is mounted the grinding head. Cross slide permits manual adjustment of this equipment up to 1", while the spindle is stationary. The cross slide itself can be adjusted up to the limit of .100" while spindle is in motion. This is accomplished by turning the large knurled dial, mounted in the opening near the top of the spindle head unit. The dial is graduated with 100 lines, each graduation representing .0001" movement of cross slide.

Three special grinding heads can be attached to this cross slide giving a total range of grinding wheel speeds from 15,000 to 80,000 r.p.m. Both air and electrical equipments are available. Air and electrical connections come into spindle at top and are carried all the way down inside spindle unit. This enables protection of lower working parts from emery dust.

The up and down feed on the vertical slide can be set to work for automatic reversing so that grinding wheel reciprocates but can also be tripped or reversed by hand at any position.

The grinding range covers holes as small as .090" in diameter or even less up to 4"—if 1" wheels are used—either straight or tapered.

Please address the makers for further details.

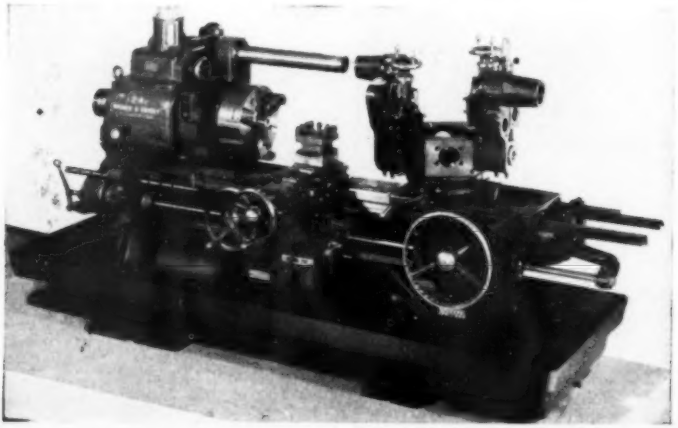
A New Saddle Type Turret Lathe

A new 2-A saddle type turret lathe is announced by The Warner & Swasey Co., Cleveland, O.

With an effective swing of 20" and a bar capacity through the spindle of 3½", the new machine has been extensively redesigned in many important details. Major improvements include a heavier walled hexagon turret, completely redesigned aprons, a new type single lever control for feed selection, a new head brake, and an improved system for lubricating the head stock. The Preselector is now standard equipment on this 2-A machine.

The new rigid bed design is used, which is now standard on all of the Company's saddle type machines. Multiple disc clutches on the rapid traverse not only make it easier to apply power to the turret unit, but give the operator better control over its operation. By a slight pressure on the control lever, the heaviest turret and tool assemblies can be moved smoothly and quickly along the bed. The rapid traverse nuts are mounted on antifriction bearing so remove radial loads from the feed shaft proper.

Twelve spindle speeds, running in a geometric progression from 17 to 460 r.p.m. are provided. With a two speed



"THESE DRILL PRESSES GAVE ME THE JUMP ON THE FIELD"

. . . and I can get them quick!

That's what a leading manufacturer told us recently. By utilizing batteries of Delta low-cost drill presses he was able to handle a series of light operations economically — reduce his costs materially — and announce new low prices that gave him a distinct edge on competition. Today — despite a greatly accelerated demand — Delta can give you, too, 11", 14", and 17" drill presses quickly — at prices from ⅓ to ½ of heavier, less efficient equipment.

The 14" bench type drill press with production type base illustrated to the right gives you: ½" drilling capacity in cast-iron, 4" spindle travel, drills to center of 14" circle, table 16" wide, 14" deep, 19½" from bottom of chuck to table, table has 1½" oil trough with ½" tapped drain hole at rear.

$59.85
No. 1011-without motor or switch.

Send For CATALOG

Mail coupon for latest Delta Industrial Power Tool Catalog. It contains specifications and prices of complete line of Delta Drill Presses plus details on individual parts from which you can make your own low cost assemblies.

DELTA
MANUFACTURING CO.
(Industrial Division)
613 E. Vienna Avenue
Milwaukee, Wisconsin

Delta Mfg. Co., (Industrial Division)
613 E. Vienna Avenue, Milwaukee, Wis.

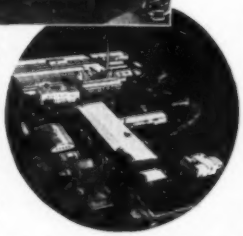
Gentlemen: Please send me your latest Delta catalog which contains specifications and prices of your complete line of Drill Presses.

Name .....

Address .....

City ..... State .....

★ **Tanks and Guards on Famous K & T MILLING MACHINES**
Made with
LIBERT
Hi-Speed
SHEAR



In the great Kearney & Trecker Factory, Milwaukee, dedicated to high precision standards in Milling Machines, LIBERT Hi-Speed SHEARS stand up to all their requirements for high speed production and minute accuracy.

K & T Machinists like the Libert Shear for its fast, accurate cutting, its ability to take inside cuts without a starting hole, and the sure, easy way it takes all manner of intricate shapes without adjustment.

A LIBERT Hi-Speed SHEAR pays for itself in many plants. Let us show how YOU may benefit by its superior shearing efficiency and versatility.

Ask your LIBERT Distributor for a Demonstration or write for latest bulletins.

LIBERT MACHINE COMPANY
Green Bay, Wisconsin
Manufacturers of Shears since 1915

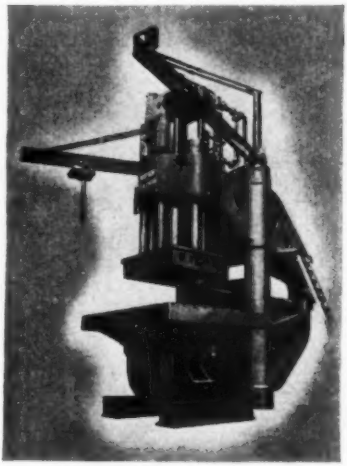
Libert Hi-Speed SHEAR

motor, double this speed range is available. The gearing, bearings, and lubrication are all designed to handle modern loads. The universal cross slide has 16 reversible power feeds, which increase uniformly to provide a proper range for all classes of work.

The machine can be equipped with a cross slide taper attachment, an open type square turret, hand or power feed compound cross slide, independent lead screw attachment, thread chasing attachment, or other auxiliary equipment designed to meet particular production problems.

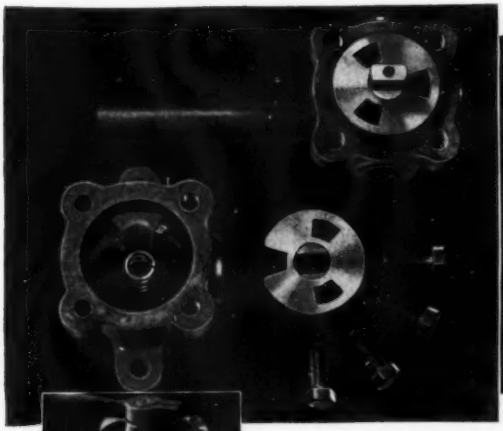
Press Design Provides for Work Accessibility

A new type of giant hydraulic flanging press has been developed by The Watson-Stillman Co., Roselle, N. J.—designed so that the work is readily



and conveniently accessible. This was necessitated by its intended use overseas. Servicing—even special operating instructions—had to be eliminated to the fullest extent possible.

Of 1,500 metric tons rated capacity, this mammoth overhung gap type press has three single-acting moving-down cylinders—one of 1,000 m.t. capacity,



NOPAK AIR CONTROL VALVES

engineered to improve with use!

NOPAK FEATURES

- No Air Loss thru Valve Leakage
- Packless Construction —no maintenance
- Pressure Sealed
- Protected, wear-proof disc and seat
- Quick or throttling action, as desired
- Full pipe area thru Valve.

Write for Bulletin 65.

Simple, Rugged Design for Efficient, Satisfactory Service

THE NOPAK patented, flat-disc principle results in highly simplified design, rugged construction, no *wearing* parts! The flat bronze disc is *ground* and *lapped* to make a perfect seal with the seat. This exclusive NOPAK feature continues the uniform "lapping-in" process while the valve is in operation. The result... absolutely leakproof sealing surfaces that actually improve with use!

The *packless* stem assembly positively prevents air or pressure loss through stem leakage . . . eliminates packing replacement, maintenance service and expense.

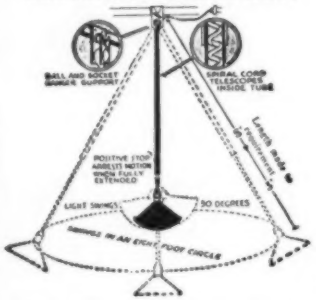
Simple, rugged, Packless, Flat-Disc construction is the basic patented feature embodied in all models of NOPAK Valves. It is your guarantee of long-lived, low cost, trouble-free valve operation whether you specify NOPAK Valves for Air, Gas, Oil or Water — or for heavy Hydraulic Service.

GALLAND-HENNING MFG. CO.
2754 S. 31st STREET
MILWAUKEE, WIS.

NOPAK VALVES and CYLINDERS

A 2789-½

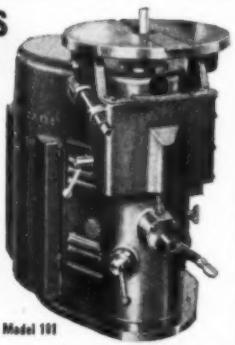
Light - Universal Movable
NO GLARE
WORK IN SOFT MELLOW LIGHT


BALL AND SOCKET SHADE'S SUPPORT
SPIRAL CORD TELESCOPES INSIDE TUBE
Length Adjustable
POSITIVE LOCK ABSOLUTE MOTION WHEN FULLY EXTENDED
LIGHT SWINGS
90 DEGREES
SHADE'S IN AN EIGHT FOOT CIRCLE

Push it up, pull it down, swing it out, swing it around, it stays put.
Write for literature.

J. Zagora Machine & Gear Company
1321 S. Mint Street, Charlotte, N. C.

PETERS
VERTICAL OSCILLATING GRINDER



The modern method of grinding and stoning tools and dies, permitting greater accuracy, quick job changes, perfection of finished parts and rapid production—with savings up to 80% in manufacturing costs. *Write TODAY for bulletins giving full information.*

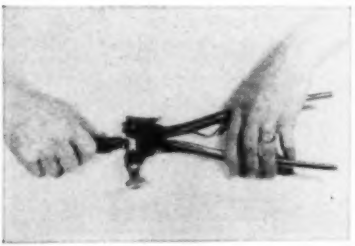
PETERS TOOL CO., INC.
114 E. Scott St., Milwaukee, Wis.

and two of 250 m.t. capacity each—so providing an actual press working capacity of 500, 1,000 or 1,500 metric tons. The two pullback cylinders are of 51 m.t. capacity each, and the horizontal double-acting cylinder has a capacity of 250 m.t. Stroke of the main cylinders is 59"; that of the horizontal cylinder, 6'7". Dimensions of the moving platen are 8'2⅜" by 6'6¾"; the bottom platen measures 14'9" x 12'5⅝", and the horizontal ram face 24" x 19¾".

Incidentally, success of the W-S engineers in meeting the exacting requirements is indicated by the fact that the initial order covering four of these presses of various sizes has been increased by four additional presses of the same type.

Single Wheel Numbering Pliers

H. O. Bates, 251 N. Broad St., Elizabeth, N. J. announces a hand machine for stamping or impressing numbers or letters into tubes, rings, bars, shanks, small cylinders or parts by use of plier action.

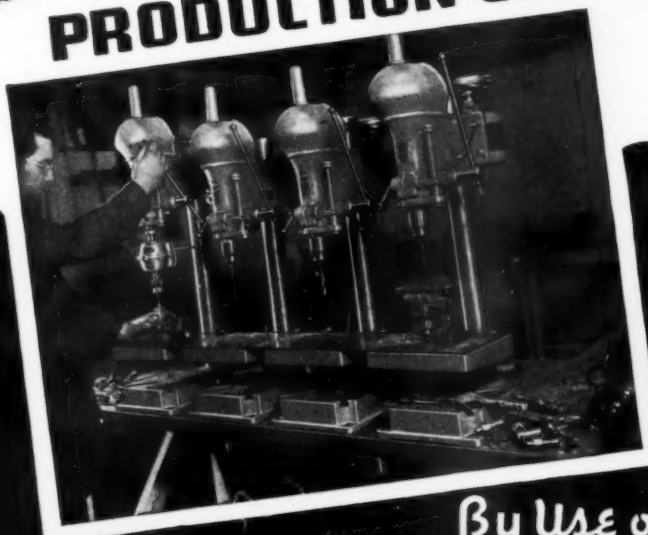


It successfully marks steel, brass, plastics, fibre, wood and other materials and is particularly useful for stamping sizes and product numbers.

It is adjustable to a variety of diameters and the number wheel can be engraved to order with letters or figures from 1/32" to ¼".

New illustrative literature describing this and other new and improved marking devices will gladly be mailed upon request.

Lower PRODUCTION COSTS!



By Use of DURO PRECISION BALL BEARING DRILL PRESSES

A Chicago Manufacturer reports a surprising reduction in his production costs on these drilling and tapping operations since installation of this battery of four Duro Precision Ball Bearing Drill Presses. The operator moves quickly from one spindle to the next for continuous production. Just one set up where two were formerly required. And what is equally important, this new equipment costs less than ½ as much as his older and less efficient equipment.

Let us show you how you too can reduce your costs by installing modern precision tools.

Manufactured By

The Makers of America's Finest and Most Complete Line of Power Driven Machinery.

DURO METAL PRODUCTS COMPANY

Dept. BB-2 **2655 N. KILDARE AVE., CHICAGO, ILLINOIS**

AT NO EXPENSE
Special 10-Day Trial
PROVES ITS SAVINGS!

TRY THIS SENSATIONAL
KIPP air GRINDER

This FREE trial offer permits any concern, with a satisfactory credit rating, to try out any Kipp Air Tool for ten days. There are grinders ranging in price from $9.75 to $58.75, Chippers and Filers at $19.75. Kipp Air Tools give you highest speeds, lowest prices — and are proving indispensable in hundreds of tool rooms and production departments. New Catalog gives details. The AG Grinder shown is only $19.75!

Mirror Finish Tips . . . just what the name implies for mirror-like finishing work.

Grinding Wheels . . . superb quality recommended for use with Kipp Grinders.

FREE TEN DAY TRIAL
FREE CATALOG

☐ Send Kipp Air Grinder Model AG on your 10 day Free Trial Offer!
☐ Send the New Kipp Air Tool Catalog!

Name.....
Company.....
Address.....

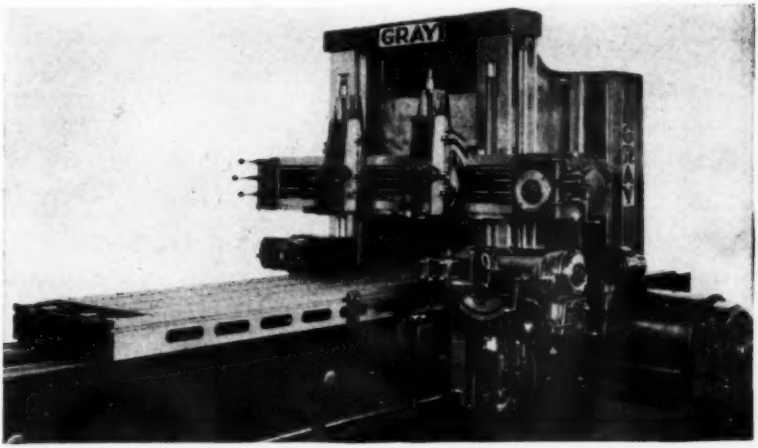
MADISON-KIPP CORPORATION
207 WAUBESA ST., MADISON, WIS., U. S. A.

1940 South Bend Workshop Lathes

The South Bend Lathe Works, South Bend, Ind., has recently published a new 48 page catalog, illustrating and describing their complete line of 9-inch workshop back-geared, screw cutting lathes and attachments. A copy of this Catalog No. 50 can be had free on request by writing to the Company, attention of the Technical Service Dept.

The lathes shown are recommended for machine shops, repair shops, manufacturing plants, garages, laboratories, home workshops, and experimental shops where the finest types of back-geared, screw cutting lathes are required. Of special interest are the new quick change gear workshop lathes, which are offered at reduced prices.

Twenty-four different models of 9-inch workshop lathes are shown. They include the Model A lathes, with quick change gear C lathes, with hand cross feed and plain change gear equipment. Each of these different models is illustrated and described with horizontal motor drive, 12 speed motor drive, V-belt motor drive, countershaft drive, underneath belt motor drive, and pedestal motor drive.



G-E Variable Voltage Drive for Planer

A new variable voltage drive for reversing planers is announced by the General Electric Co., Schenectady, N. Y.

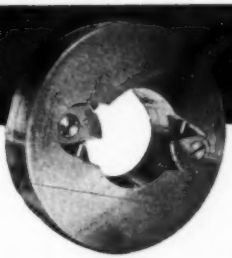
The new 35 h. p. drive is shown applied to a Gray double housing planer, 42" x 42" v 12 ft., and provides a speed range of 40 to 1200 r.p.m., giving eight to 240 f.p.m., platen speed.

Obviously, the new drive offers advantages in the way of a wide speed range, rapid acceleration and deceleration, high cutting efficiency, accurate stopping and simplicity of control. Additionally, the equipment affords independent selection of cutting and return speeds throughout the entire speed range, as well as a maximum number of strokes per minute on all stroke lengths.

It is said that tests have shown production increases ranging from 25% up through the use of this new drive on modern planers.

The drive comprises a drect-connected planer drive motor and an independent motor-generator set. So far as control is concerned, a total of nine contactor and relays is the sum total of operating devices on the control panel.

Table speeds up to 240 f.p.m., may be had with suitable gear ratios in the planer.



for your lathes SENECA FALLS Automatic WORK DRIVER

Self Centering . . . Quick Acting . . . No Slip. Attaches to any chuck plate or spindle. Provides a slip-proof, balanced drive reducing chatter. Handles rough forgings or turned pieces—straight or taper. Eliminates dogging time. Reduces tool breakage. Write for details and size range.

SENECA FALLS MACHINE CO., 314 Falls St., Seneca Falls, N. Y.

Precision Collet Chuck

FASTER WORK made easier. Positive 8-point grip collapsible collet holds drill or end-mill true under heavier feeds and faster speeds. Small nose-piece dia. gives clear view.

Sizes, 1/2" diam. to No. 80 Drill.

7 BIG POINTS

8-Point Grip.
High Accuracy.
Faster operation.
Less Drill Breakage.
Parts Interchangeable.
Unusual Range per Collet.
Holds on flutes — Broken Drills can be used.

Pat. Pending

Want More Output? Write us.

ERICKSON STEEL CO.
East 80th & Bessemer,
Cleveland, Ohio

KENNAMETAL
THE FIRST SUCCESSFUL CARBIDE FOR SHAPING HARDENED STEEL PARTS

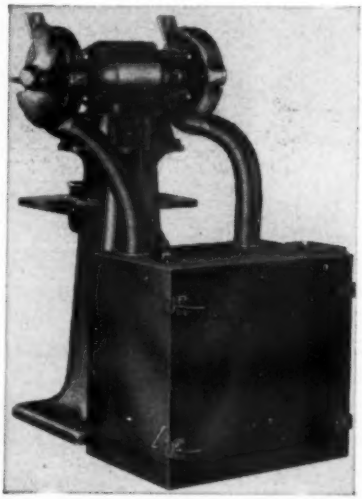
Because of the lower frictional resistance of KENNAMETAL to steel chips, it has been possible to design the new KENNAMETAL—tipped shaper tools with more efficient tool angles; namely, 10° neg. back rate, 5° neg. side rake, 80 side-cutting edge angle and 4° clearances. These angles should be maintained when re-grinding tools to assure best results.

The new KENNAMETAL shaper tools are supplied in sizes to fit standard clapper boxes on shapers and planers. Write for complete information today—also ask about other KENNAMETAL tools for turning, boring and milling hardened steel parts.

McKENNA METALS Co
135 LLOYD AVENUE
LATROBE, PENNSYLVANIA, U.S.A.

The Cincinnati "Air Master"

Here is an effective, self-contained dust collector, developed by The Cincinnati Electrical Tool Co., 2701-7 Madison Rd., Cincinnati, O.



Dust and grit laden air is filtered through a series of closely woven fabric and steel wool filter bags and exhausted through an opening in top of cabinet.

Heavier particles fall into a large tray in bottom of the cabinet and a foot lever is provided for shaking the lighter dust from the filter bags into the tray.

The unit is applicable to all makes of grinders and buffers having exhaust outlets. Fan motor is connected into the same switch which controls the grinder, and starts simultaneously with the machine. A metal partition excludes dust from motor compartment.

Two sizes are provided, viz., for wheels up to 10" diameter by 1½" and for wheels over 10" diameter and up to 14" diameter by 3" face.

A new bulletin gives full details.

2 New Models

In the WYCO line of Flexible Shaft Equipment

WYCO BALL BEARING 3-SPEED JACK SHAFTS FOR BENCH OR FLOOR MOUNTING

Bench and floor mounting units to drive a Flexible Shaft from a counter shaft or by using your own motor or gasoline engine. Rigid construction with heavy cast iron base, drilled to mount on floor or bench.

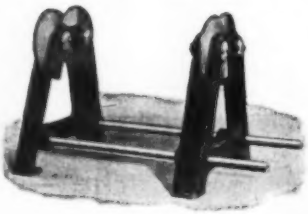
WYCO MODEL No. 33—3-SPEED MACHINE

"The latest thing" in flexible shaft design.
Multiple Speed Flexible Shaft Machines are recommended wherever a variety of operations are to be performed. Proper speeds can be selected instantly for grinding, polishing, sanding, or wire-brushing. High Speed Precision—1800—3600—6000 R. P. M.

Send for our New 30 Page Catalog describing these and all the other machines in the broad line of WYCO Flexible Shaft Machines. Write today.

Wyzenbeek & Staff, Inc.
838 W. Hubbard St., Chicago, Ill.

ANDERSON Improved Balancing Ways



Equip your shop with this accepted method of balancing rotating parts—checking, straightening and truing operations.

Anderson Improved Balancing Ways are simple, sturdy and dependable. They save time, effort and trouble—assure better work.

Four chilled iron discs rotate with minimum friction on sensitive special bearings, giving a prompt, sure indication of whether or not the work is in perfect balance.

Swing	Greatest Distance Between Standards	Capacity in lbs.
20 in.	20 in.	1,000
40 in.	30 in.	2,000
60 in.	30 in.	2,000
72 in.	66 in.	5,000
96 in.	88 in.	10,000

Let us tell you more about this and other useful Anderson equipment. Your request will bring full details promptly.

Anderson Bros. Mfg. Co.
1907 Kishwaukee Street,
ROCKFORD, ILLINOIS

Burgess Phone Booth for Noisy Factories

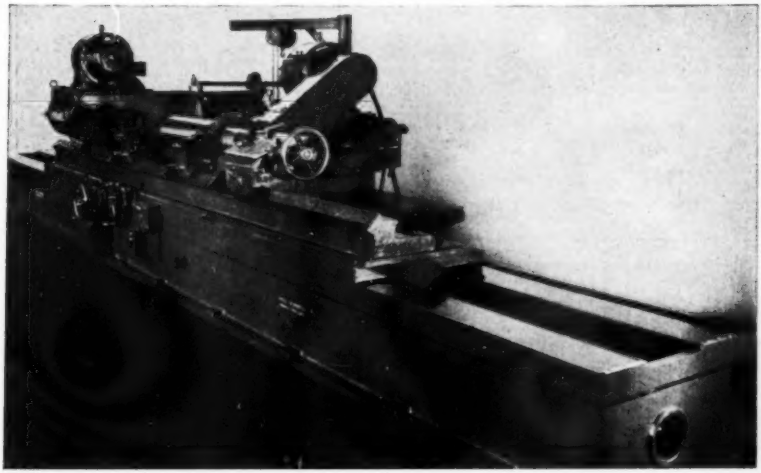
A new model of the Burgess Acoustical Telephone Booth, replacing the old Model 201 booth, was recently announced by the Burgess Battery Co, Acoustic Division, Dept. HM, 500 W. Huron Street, Chicago. The new Model 204 booth is designed to provide a zone of quiet for telephones used in factories and other noisy industrial locations.

The new model, like other Burgess acoustical booths, has no doors. It is lined with a heavy layer of sound absorbing material protected by perforated steel facing developed by the Burgess Laboratories. Owing to its patented acoustical construction, factory noises and disturbances are absorbed so completely by the lining that telephone calls can be made without interference from factory noises. Conversations in ordinary tones are not heard outside the booth, thus assuring privacy. Added advantages are ample ventilation, due to its open construction, and freedom from door troubles.

The Model 204 booth is made of heavy gauge, black finished steel for exterior walls. Interior walls are finished in gray. It is furnished complete with metal shelf for telephone, a small panel for the ringer box, and pull-chain overhead light.

Overall dimensions — height 79¾"; width 31"; and depth 38". Front opening—24" wide, 76" high. Net weight approximately 275 lbs. Illustrated booklet will be sent on request.

Cylindrical Grinder With Traveling Work Table



A new cylindrical grinder is announced by Farrell - Birmingham. Known as the Type TT, it incorporates a traveling work table and a fixed grinding wheel unit, and is equipped with a sensitive reversing mechanism which permits grinding right up to the shoulder of the shaft. Once set, the traverse and reversal of the traveling work table are automatic and require no further attention.

It can be set for any work and then operates automatically. All mechanical and electrical operating controls are within easy reach of the operator's station.

To permit moving the traveling table by hand, a handwheel and clutch are provided and there is also handwheel control for hand-feed of the grinding wheel as well as electrical controls for rapid in - and - out movement of the wheelhead. The traveling table may be reversed by hand or automatically and lever contact control is provided for rapid traversing of the table. Start and stop push-button stations control the motors driving grinding wheel, traveling table and water pump, and a start - jog - stop station controls the headstock. There is also an emergency master stop station, with re-set button and red indicating light.

Design of the work table drive has been improved to provide positive, vibrationless traverse, steadiness of travel and smooth, accurate reverse. The table is driven by an adjustable speed reversing motor, through a two-speed drive with accurately generated double helical gears, through worm and worm gear to a worm meshing with a drive rack on the traveling table. This is asserted to be the smoothest type of drive known for machine tool carriages. Reversal of the table is accomplished electrically, eliminating mechanical reversing clutches.

Full information may be obtained by writing to the Ansonia, Conn., offices of Farrel-Birmingham Co., Inc.

K-O Adjustable Clamps

Adding a new adjustment feature to the old style U-clamp, this K-O device should be exceedingly useful in clamping dies, fixtures and work of all kinds on punch presses, planers, milling machines, drill presses, etc. A ratchet or step elevation base affords quick and easy adjustment to the level of the work to be clamped. Three point contact assures uniform pressure. A style is provided for general machine work. A nose clamp type is available for surface work of all kinds on planers, shapers, millers, etc., and a heavy duty design may be had for the larger dies and general machine work.

Another innovation is the new K-O Vise Clamp which combines the functions of a drill press vise, toolmaker's clamps, V-blocks, drill jig and angle plate. It is available in two sizes. No. 1 handles stock up to 1¾" in thickness or diameter. No. 2 takes flat or round pieces up to 2¾".

A bulletin giving full details may be had by addressing K-O Products Co., Benton Harbor, Mich.

G. E. Gustafson Passes On

George E. Gustafson, General Works Manager of the Kearney & Trecker Corp., West Allis, Wis, was killed in an automobile accident January 8th.

His association with Kearney & Trecker covered a period of 13 years, during which he advanced successively from salesman to Sales Engineer, Advertising Manager and Works Manager.

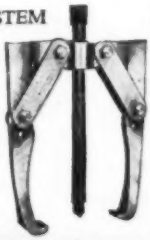
OTC GRIPOMATIC PULLERS

Capacities 5 to 40 TONS

For PLANT MAINTENANCE

The patented gripping feature prevents slipping, avoids damage and simplifies work in close quarters. Alloy steel—fully Guaranteed.

OTC PULLING SYSTEM includes many sizes and types of Pullers and Pushers for installing and removing gears, bearings, wheels, pulleys, sleeves, shafts.

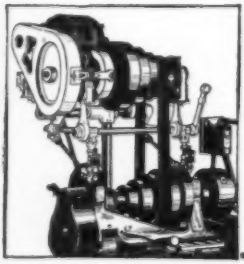


Special Pullers designed and made for special needs.

Write for catalog H.

OWATONNA TOOL CO.

355 CEDAR ST. OWATONNA, MINN.



All right, Mr. Smith--

YOU tell them about Remco Drives

. . . "your drives are all working entirely satisfactory and in my opinion, they are the best drives on the market." —We quote L. B. Smith of L. B. Smith, Inc., Camp Hill, Pa. Learn how your PRESENT machine tools may be Remco equipped—at surprisingly low cost. Write for FREE folder. Remco Products Corp., State St. & R. R., York, Pa.

REMCO MOTOR DRIVES

for LATHES, SHAPERS, DRILLS, MILLING MACHINES, etc.

THE ONLY TAPPER WITH A LEATHER CLUTCH

Ettco - Emrick

TAPPING ATTACHMENTS

ETTCO pioneered sensitive small tapping 15 years ago with a leather lined friction driving clutch.

As yet we have found no substitute to equal the smooth, consistent super-sensitive action of leather for the exacting requirements of tapping.

ETTCO Tappers are now more powerful and sturdy and give more satisfaction than any we have ever made.

The Tappers have ball bearing spindles — needle bearing intermediate gears and all helical gears to insure the greatest possible speed.

Seven sizes—
From No. 1 to 1 inch Taps

These tappers are used with the **ETTCO** ***multiple tapping system*** and our No. 71 ***gravity foot operated tapping machine.***

ETTCO TOOL CO.

594 JOHNSON AVE., BROOKLYN, N. Y.

CHICAGO CINCINNATI DETROIT

"ALIVE" Ball Bearing Centers

"They turn with the work"

Write TODAY – and let us tell you more about them.

MODERN MACHINE CORP.

323 Berry St., Brooklyn, N. Y.

Baldor Carbide Tool Grinder

The Baldor Electric Co., 4368 Duncan Ave., St. Louis, Mo, presents a brand new carbide tool grinder.

According to the manufacturer, this new grinder operates with a minimum of vibration as a result of the heavier and shorter shaft. Another important item emphasized is the elimination of end play in the armature which is said to permit finer grinding.

According to the manufacturer, this new grinder operates with a minimum of vibration as a result of the heavier and shorter shaft. Another important item emphasized is the elimination of end play in the armature which is said to permit finer grinding.

The motor is of ½ h.p. capacity, operating at 3400 r.p.m. The motor is reversible.

Tool rest tables are 10" x 3½" and adjustable to compensate for wheel wear. Table angle is indicated by a protractor mounted on either side of

BAUMBACH

STANDARDIZED

Machined Steel DIE SETS Semi-Steel

Drop Forged Steel

Headquarters for Standardized Die Sets, embodying many exclusive features and embracing more than 195,000 stock sizes and 46 different styles. A die service that is unsurpassed. Let us prove it!

Send for our new 336 Page Catalog.

E. A. BAUMBACH MFG. CO.

1810 So. Kilbourne Ave., CHICAGO, ILL.

OPEN CLOSED

Plain Type

TRADE AUTOM MARK

CLOSED

Offset Type

OPEN

CONTINUOUS HINGES

All hinges shown can be furnished with special holes, cutouts and bends to blue-print in metals to suit the job.

AUTO MOULDING & MFG. CO.

2326 S. CANAL ST

CHICAGO

SPECIFICATIONS:

Open Width 1/8" to 6"

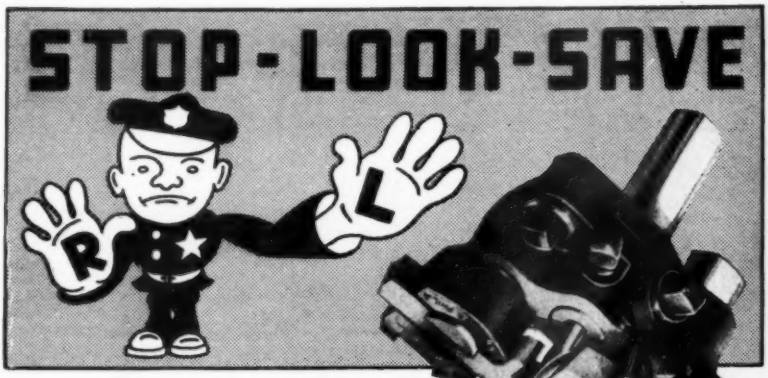
Gage Material .040 to .125

Pin Diameter .101 to 1/8

Lengths to 120"

THREE-FOURTHS OFFSET.

SEMI-OFFSET



R AND L TURNING TOOLS

STOP the losses which will become increasingly important with rising production schedules. You can go a long way in that direction with R & L Tools. They save hours in set-up time . . . and the multiple operation feature cuts production cost, permitting two or three operations to be performed simultaneously . . . for example, drilling, turning and burnishing at one time. R & L tools save time and money on multiple spindle machines, where otherwise, additional operations would be required.

LOOK into the possibility of using R & L tools in your plant. Others have found that R & L tools speedily pay for themselves, and thereafter return a worthwhile profit.

SAVE at least $200 on the initial cost alone—over the investment required for separate tools to handle the jobs you can do with one R & L costing but $65. In addition to the operating savings, R & L maintenance is less, due to sturdiness and simplicity and a minimum number of wearing parts.

Surely you will want the whole story on R & L Savings. Write TODAY!

R and L Tools, 1825 Bristol St., Nicetown, Philadelphia, Pa.

BURKE

MILLING MACHINES

Make Fast Work of Small Jobs

Motor Driven

Timken roller or ball bearings to spindle

Write today for circulars.

Burke Machine Tool Co.
297 E. 16th St., Conneaut, Ohio

"CHAMPION" Steel Racks

Save time, steps and money by keeping bar stock, shafting and pipe out of the way and off the floor.

Write for full details.

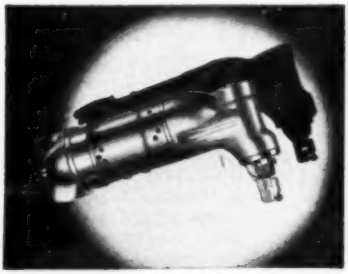
The Western Tool & Mfg. Co.
Springfield, Ohio

grinder. A protractor type tool support is also provided which gauges horizontal angle of the tool. The mounting flanges accommodate either steel backed silicon wheels or diamond wheels.

Full details are given in bulletin No. 72.

Thor Electric Nibbler

A small, portable electric nibbler for cutting all kinds of sheet metal is offered by the Independent Pneumatic Tool Co., 612 W. Jackson Blvd., Chicago. Only nine inches long and weighing but 3¾ pounds, it is a compact tool with a yoke type front head



incorporating a punch and die that "nibbles" out a rectangular shaving of metal at each upward stroke of the punch. The Thor Nibbler will cut up to No. 18 gauge (.049") in steel and up to No 15 gauge (.072") in aluminum. Bulletin E-31 gives full details.

Miniature Ball Bearings

R M B

This is the R series in actual size. Other series are available **down to .060" O. D.**

A complete line of small ball bearings. Types for radial, axial or angular loads. Easily mounted—widely adaptable.

Write for catalogue No. H.2.

LANDIS & GYR, Inc.
104 5th Ave., New York

CANEDY-OTTO No. 18 ROYAL

Floor and Bench Model Drills

Featuring:

6 Speeds, 240 to 2185 with 1200 r. p. m. motor—345 to 3250 with 1800 r. p. m. motor.
18" swing 5¾" spindle travel.
Sand cast, machined V-belt pulleys.
Alloy steel 6-splined spindle, ground and polished.
High grade Lubri-seal ball bearings throughout.
Spindle cone pulley rotates between annular ball bearings.
Bench base working surface 16"x 16", over all 21½"x28".

These are sturdy, dependable drills, capable of accurate drilling on rigid day-after-day production schedules. Supporting columns are rugged. The Lubri-sealed bearings assure easy running and long life. Working surface is handy—and the three spoke feed is fast and easy to operate. Capacity up to ¾" with ½ h. p. motor, or up to one inch with ¾ h. p. 1200 r. p. m. motor.

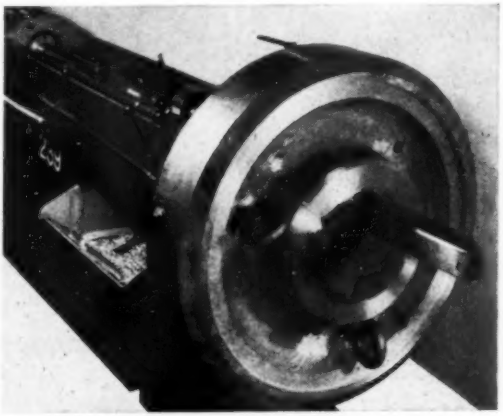
CANEDY-OTTO MANUFACTURING CO.
CHICAGO HEIGHTS, ILLINOIS

Accurate Machining of Large Splines

Producing of accurate splines on large wheels and gears in limited quantities has been facilitated through development of a simple broaching process by Colonial Broach Co., Detroit.

As will be noted from the illustration, the equipment consists of a standard Colonial Universal horizontal broaching machine equipped with accurate index plate mounted on the face plate of the machine. Broaches are pulled through the work.

In the example illustrated, it was required to machine 10 splines in the 11½" I.D. blank shown. The splines themselves are one inch deep,



1¾" wide, and approximately 15" long, with tolerances of as little as plus or minus one half thousandth for width and depth and total accumulated error.

To perform the operation, two broaches are used to take care of the large depth of cut. Stroke, however, is relatively short, considering the length of the splines involved. Each spline is completed in turn, before indexing to the next position. In view of the extreme accuracy required, the index mechanism is held to plus or minus nothing.

The blank illustrated is for one of a number of Cone-Drive area-contact worm wheels, produced by Michigan Tool Co., Detroit. The material is a high tensile bronze.

Welders Coupled in Series

By means of special connecting cables, the K. O. Lee Co. have now made it possible to connect any two of their A.C. Arc Welders, thereby attaining the combined amperage output of both welders. This arrangement should prove economical in most shops that have heavy welding to do, requiring

WHEN BUYING
CUTTERS
look for the name
QUALITY
All standard sizes carried in stock for immediate delivery. Special cutters made to Blue Print.
As Cutter Specialists since 1919 we are able to offer the highest *quality* and *service* at *attractive prices.*
Write today for prices. *Few Territories Open.*
QUALITY TOOL WORKS
WAUKEGAN, ILLINOIS

SPECIFICATIONS:

Price listed is for 3-Speed Gear Box Only.

4-Speed units—$10.00 additional.

Brackets with motor rails for most machines carried in stock—prices quoted upon request. Please advise make and size of machine drive is to be mounted on.

Power take-off on either end of unit optional.

PRICE

$87.50

F. O. B. DETROIT

Gears are heat treated and run in oil.

Pulley Shafts—1¼" dia., fitted with ball bearings and special oil seals.

Belt adjustments provided.

Designed to drive machines that require from 1-HP to 5 HP motors.

DRIVE-ALL MANUFACTURING CO.

3401 CONNER AVE. :—: DETROIT, MICHIGAN

REPAIR CONCRETE to a TOUGH *Feather* Edge!

RUGGEDWEAR RESURFACER, made with cellulose, may be used for patching concrete or over an entire area . . . indoors or out. Stands up under the heaviest floor traffic. No chopping or chipping required. Merely sweep out the spot to be repaired—mix the material—trowel it on. Holds solid and tight right up to the irregular edge of the old concrete . . . leaves no joint or crevice to become chipped or filled with dirt. Provides a firmer, tougher, smoother, more rugged wearing surface. Dries fast. Costs only 10c to 14c per square foot. RUGGEDWEAR is the only Resurfacer made with cellulose.

Valuable, 60 page "HANDBOOK of BUILDING MAINTENANCE" sent FREE to those requesting on business letterhead.

MAKE THIS TEST!

FLEXROCK COMPANY
2305 Manning St.
Philadelphia, Penna.

Please send me complete RUGGEDWEAR information . . . details of FREE TRIAL OFFER—no obligation.

Name .....

Company .....

Address .....

City ..... State .....

electrodes larger than ¼". The K. O. Lee line includes three sizes of welders, of 150, 200 and 250 amperes, respectively, the largest of which will handle ¼" welding rod. For handling larger work, it is recommended that two units be coupled together, as illustrated, for attaining the necessary amperage. It is claimed that two welders can be coupled as easily as plugging into a light socket. If two 250 amp. welders are coupled in this manner, the combined welding capacity is 500 amperes, handling electrodes up to ⅜" diameter.

Almost any desired welding heat can be obtained as there are innumerable combinations of heat stages.

It is claimed that the purchase of two small units (up to 250 amps.) is advantageous over the purchase of one large welder having the capacity of the two small ones. When the smaller units are purchased, two operators can weld simultaneously, either at the same job or in different parts of the shop. It is claimed that most welding work is done with a rod size that requires less than 250 amps., and that only a small percentage of the work done in the average shop requires a larger machine. For this reason it is economy to buy the small independent units that can be quickly coupled together for heavy duty work.

For further information write the K. O. Lee & Son Co., Aberdeen, S. D.

How Else Could It Be Done So Economically?

Grinder set-up in Milling Machine grinding radius on metal-cutting saw.

STANLEY TOOL ROOM GRINDERS PLAY IMPORTANT PART IN MANUFACTURE OF FINE METAL-CUTTING TOOLS

"Five years ago we bought our first Stanley Tool Room Grinder," reports Circular Tool Company, Inc., Providence, R. I. "The fact that the original one is still handling production work every day and that we have since added *three more* is endorsement enough of these handy little machines.

"Our products, metal-cutting tools, require precision grinding at several steps in their manufacture. We handle many of these steps *in regular production* on Stanley Grinders – jobs which would otherwise have to be taken to a large machine where time had been wasted making a complicated, costly set-up."

18,000 r.p.m. – ⅜ h.p. – ample to maintain high speed on tough work – complete flexibility to handle scores of shop jobs – these advantages mean savings for you with the Stanley Tool Room Grinder. Ask your Stanley distributor for demonstration, or write for literature. Stanley Electric Tool Division, The Stanley Works, 141 Elm Street, New Britain, Connecticut.

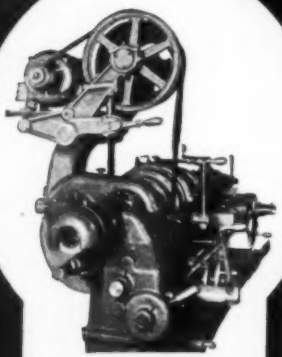
Grinder bringing center holes of slotting saws to proper diameter.

Grinder burring off center holes of metal-cutting saws.

STANLEY STANLEY **ELECTRIC TOOLS**

A COMPLETE LINE FOR INDUSTRY – "COST LESS PER YEAR"

The Keyhole to Greater Production and Profits



TORQ DRIVES

open the door to increased production — up to 25% or more—easily installed, they become an integral part of the machine—coupling increased flexibility and efficiency with a marked reduction in operating costs, TORQ DRIVES will bring your equipment up to modern standards of performance.

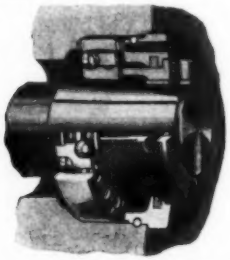
- Variable Belt Tensioner
- All Steel Welded Column
- All Parts Fixture Machined and Bored
- Rigid Construction
- Self Aligning Ball Bearing Housings
- Neat Appearance
- Easily Installed

Write today for bulletins giving complete information.

The Torq Electric Mfg. Co.
6606 Carnegie Ave. Cleveland, Ohio

Simplex Ball Bearing Units

To provide manufacturers with a simple and economical means of incorporating ball bearings, where the bearing housing is an integral part of the machine, Ahlberg has developed a line of bearing units known as CJB Simplex Machine Units.



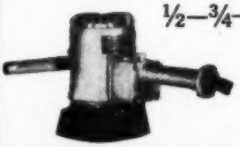
These are available in three capacities; for light, medium and heavy loads, with either single row, double row or sefl-aligning bearings. In the light series the bearings are mounted directly on the shafts; whereas, the medium and heavy units mount through a split adapter sleeve in a tapered bore bearing.

Retaining caps are optional either in the open type or the closed type, the latter sealing the bearing completely. Expansion or non-expansion units are also optional at the same cost.

Complete information is contained in a new descriptive folder available from Ahlberg Bearing Co., 3046 West 47th St., Chicago, Ill.

CUTS GRINDING COSTS

½—¾—and MORE



HEAVY DUTY

3 Phase
60 Cycle
No Brushes

GASTON POWER TOOLS
2655 W. 95th St., Evergreen Pk. Ill.

L-W HIGH SPEED

POWER HACK SAWS

Why Wait !

HERE IS OUR LATEST MODEL. IMPROVED IN D
SIGN—HEAVY DUTY—FAST CUTTING. A REAL SA
THAT WILL SAVE YOU TIME AND MONEY.

To start cut, relieve weight of saw frame, hold down on r
loose lever and lower saw to work—start machine. Automa
trip stops the machine on completion of cut. Automatic rel
of saw blade on the non-cutting stroke is also provided.

Capacity 6"x6" with 10" to 14" blades—Clutch Pulley 12½x
—Speed of Pulley 120 r. p. m.

ONLY
$147.50

Motor Drive Arrangement
$21.00
Additional

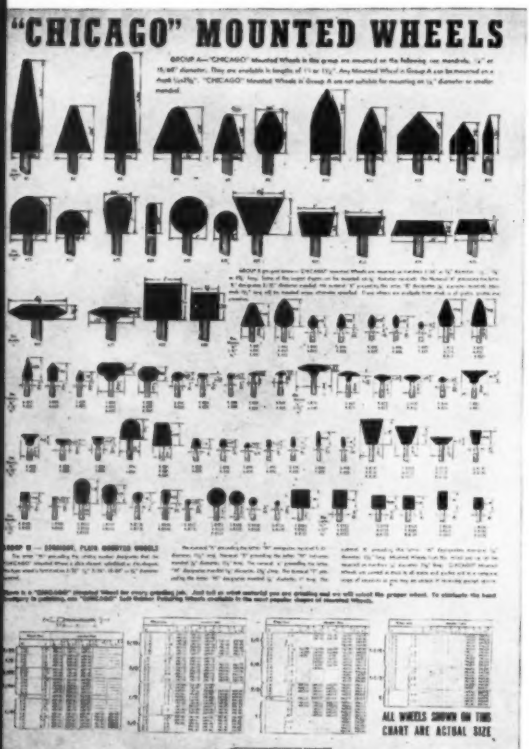
L-W CHUCK CO.

CHICAGO MOUNTED WHEELS OF V/T SUPER

150% LONGER LIFE

Chicago Mounted Wheels made of the new V/T Super Bond prove by tests conducted in many plants on snagging and exacting operations to have from 150% to 300% longer life. They're tougher; can take more punishment; grind more pieces per wheel, faster and without sacrifice of cutting action.

V/T Super Bond holds its original shape longer. Wheel will not ridge on grinding welds, sharp corners, sinking dies, barbering, and other work of this character.



V/T Super Bond meets the challenge of today's exacting requirements. Cuts your grinding cost. Let us prove it to you in your own plant on your toughest mounted wheel job.

Let us send you one of these Mounted Wheels without cost or obligation. Tell us the kind of job, type of equipment and size you want to use to make your own test.

Complete Catalog Free upon Request.

FREE MOUNTED WHEEL CHART

Ideal for ready reference in the shop. A Wall Chart 22x15", showing actual size and shape of every standard Chicago Mounted Wheel.

CHICAGO WHEEL &

Makers of Quality Products for

1101 W. Monroe St., Dept. HB,

Canadian Distributors: Canadian Trade Corp., Ltd. 1332

ER BOND

GREATEST FORWARD STEP IN 30 YEARS

V/T Super Bond is one of the most important developments in mounted wheels. Wherever the use of a tough, hard bond that will stand the gaff is required, V/T Super Bond will be found without peer. Nothing can compare with it in endurance, stamina and performance. There is a shape and size to handle every grinding job faster, better and at lower cost.

Chicago Mounted Wheels

- ✓ The FIRST small abrasive wheels mounted on steel mandrels to be offered to industry.
- ✓ The FIRST with this special new and exclusive bond — V/T Super Bond, unequalled in strength and long life.

HANDEE TOOL OF 1001 USES

Here's a small "power house" that can be carried to any part of the shop and used wherever there is an electric outlet. Repairs hard-to-get-at parts on machinery without removing the part—smooths off rough spots on dies and moulds—cleans delicate mechanisms—grinds, drills, polishes, cuts, routs, carves, sands, saws, sharpens, engraves, cleans, etc. Uses 300 accessories. There are more Handees in use today than all other tools of this type combined.

De Luxe model weighs 12 oz. 25,000 r.p.m. $18.50 postpaid with 6 Accessories.

TRY A HANDEE FOR 10 DAYS IN YOUR OWN PLANT

L & MFG. CO.

lucts for 40 Years

pt. HB, Chicago, Ill.

1332 Williams St. Montreal

- ☐ Send Free Wheel. Size _____
- ☐ Free Wall Chart
- ☐ Catalog of Handee Products and Grinding Wheels.
- ☐ De Luxe Handee on 10-Days Trial.

Name .....

Canadian Distributors: Canadian Trade Corp., Ltd.

We Have Saved 50 % on our Tool Costs by Using this Modern Service

This is what executives, engineers and mechanics all over the country have been claiming since they began having their tools reconditioned by us. Not only can we save you 50%, but we can impart 100% longer life, and increase the efficiency of your tools. This is not an idle boast, but a proven fact. If you want proof, just send us a trial order.

Our four-fold service includes:

Tool Salvage—The recutting without annealing of cutters, end mills, reamers, drills and files.

Rebuilding Pneumatic Tool parts—The restoring to original size and efficiency of all your Pneumatic tools with Hard Chrome Plating.

Master Chipping Hammers—The making of the "Master" Chipping Hammers with the "Lifetime" valve block.

Hard Chrome Plating—The rendering of longer life and greater efficiency to your Machine Parts and Dies.

All we ask you to do, is send for our catalogs giving the whole story and listing our Representative nearest you. *Investigate today.*

MASTER TOOL CO., INC.

MASTER CHROME SERVICE, INC.

EASTERN CUTTER SALVAGE CORP.

Welding Review — 1939

Progress in arc welding last year was outstanding in the fields of carbuilding, shipbuilding and heavy machinery construction.

This was due to expansion in the business of the industries named, rather than to outstanding developments in welding equipment or technique. It is a tribute to welding manufacturers collectively that their products were developed to the point where they were ready for the immediate service of industry when it became essential to have been improved to the point where step-up production from a low level to peak proportions almost over night.

Increased use of alternating current as a source of welding power has been notable. This has followed two courses in the use of unusually large amounts of power for automatic systems of welding, and in the use of unusually low welding currents.

A. C. transformer type welders have been found to supply the needs for high current, heavy duty welding efficiently and economically and development has taken the trend to 1000 ampere units. These may be operated singly or in parallel for various current ranges.

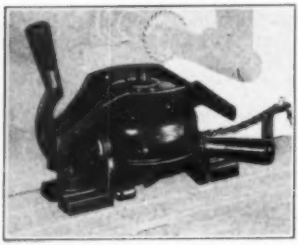
In medium and light manual welding operations, electrodes a.c. welders are readily used with current values down to 20 amperes with low open circuit voltages. Development of small a.c. welders with a wide range of types of electrodes has brought arc welding within the reach of many small welding operations where previously it was unjustifiable on account of limited requirements.

The use of Diesel engine driven welding generators increased in the construction field, for locations where electric power is not available.

These observations are by W. W. Reddie, of the Westinghouse Welding Division at East Pittsburgh, Pa.

FEDERAL
IT HAS EVERYTHING
From contact point to pointer, every detail of a Federal Dial Indicator has a very definite reason for the way it is constructed. New materials are constantly tested to determine if there is something better. New manufacturing methods are developed to improve the fidelity, sensitivity and accuracy of the instrument. At the right, the basic features which make Federal Indicators out-sell all others are listed. For design, construction and service, you receive the most from FEDERAL.
MOVEMENT — Complete Unit. Permits better alignment of rack and gears.
CASE--No screwed or soldered pieces to become loose or out of line.
BEARINGS—Federal was first to use jewel bearings. First to establish value of Full-Jewel, Low-Friction Indicators.
ACCURATE TEETH—All gears cut in our plant.
PRECISION ASSEMBLY — No watch is more carefully put together.
FEDERAL PRODUCTS CORPORATION, PROVIDENCE, RHODE, ISLAND
PRECISION MEASURING INSTRUMENTS
Chicago . Cleveland . Detroit . Hartford . Muncie
New York . Philadelphia . Pittsburgh . Rochester

CO.. INC. SERVICE. INC. SALVAGE CORP.



DEARBORN Automatic Chucking and Indexing Fixture

MILLS OVER 1000 PARTS PER HOUR

Work held by draw in collets. Collets open and close automatically. Work automatically ejected. Indexes without loss of time for milling 1, 2, 3, 4, 6, 8, 12 or 24 sided pieces. Minimum set-up time required. Speeds up production. Positive and accurate in operation.

J. W. DEARBORN

72 S. CLIFF ST. ANSONIA, CONN.

Link-Belt Vernier Control

Link-Belt Co. announces that it is now in position to equip all sizes of the

P. I. V. gear variable speed transmissions with vernier control, for extremely fine control of speed changes.

This can be supplied with either of two ratios—7½ to 1 or 30 to 1, and includes two hand wheels. One is for direct control. The vernier type control hand wheel will provide either 30 turns or 7½ turns to one of the direct wheel, depending upon which ratio of warm-gear reduction set is furnished.

A 40-page book No. 1574 covering vernier and other types of P.I.V. Gear control, will be sent to any reader upon request addressed to the Company at 2045 V. Hunting Park Ave., Philadelphia.

The New Britain *Universal* VISE

SEND FOR BULLETIN TODAY

to give you any angle or compound of angles. Swivels 360 degrees horizontally, 100 degrees vertically.

NEW BRITAIN TOOL & MFG. CO.

NEW BRITAIN, CONN., U. S. A.

"ALNOR" PYROMETERS

for every requirement.

Inexpensive, accurate, durable.

Write for catalog.

Illinois Testing Laboratories, Inc.

150 W. Austin Ave., Chicago

Motors for Small Machines

Universal governor controlled motors, available in sizes from 1/50 to 1/20 h.p., are described in a new Westinghouse leaflet. These meet the need for a wide range of applications for quiet, constant speed, lightweight motor drives.

They are equipped with rotating contact or hinge type governors, or may have supporting arms for special type governors. Die cast housings of aluminum alloy save weight.

Full details are given in leaflet F-8498.

General purpose type universal motors made flat so that they may be mounted to occupy a minimum of space, are discussed in leaflet F-8494. Holes are drilled and tapped in one of the flat sides to permit attaching mounting bracket.

Copies may be obtained from department 7-N-20, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

STANDARDIZED JIG BUSHINGS

Prompt delivery from stock on over 10,900 standard items—over 6700 ACME Standard—over 4200 A. S. A. Standard—all completely finished ready for use. *Special sizes made to order.*

Made in our new plant by the most exacting and scientific methods—insuring accurate fit plus long wear—concentric within .0003" full indicator reading.

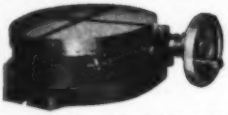
Send for bulletin containing complete data and low prices. Satisfactory service guaranteed.

Also manufacturers of complete machine parts, specializing in **hardened and ground** parts requiring **extremely close limits, lapped fits, etc.** also **hydraulic appliances** for pressures up to **20,000 lb.** per square inch.

ACME Industrial Co.

210 N. LAFLIN ST., -:- CHICAGO, ILL.

TROYKE ROTARY TABLES



Moderately Priced

Made in 9", 12", 15", 18", 21", 25".
With or without dividing plates.
Ask your dealer or write us for complete catalog.

ALFRED A. TROYKE
221 E. Second St. Cincinnati, Ohio

KOEBELITE
DIAMOND TOOLS

★

Deliver a Known Quantity—and Quality —of Service

★

KOEBELITE is the trademark of KOEBEL DIAMOND TOOL COMPANY
DETROIT

Speedy Punching Production

A new hydraulic punching unit employing a balanced spring principle has permitted a manufacturer of windshield and window trim mouldings to make a drastic cut in the time required for punching and countersinking mounting holes in mouldings.

Upwards of 200 mouldings per hour, with from 12 to 16 holes each are now being turned out per fixture (one operator per fixture) with the new equipment. Previously conventional punch press equipment was used. Some of this saving is also attributable to eliminating the necessity for accurate manual positioning of the work. This function is provided by the punching units themselves—without costly cam dies, etc.

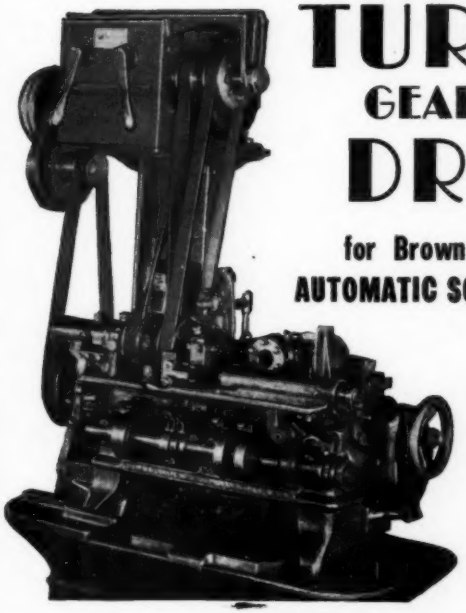
The complete punching fixtures, designed and built by Progressive Welder Co., 707 Piquette Ave., Detroit, Mich., comprise from 12 to 16 individual hydraulic punching units (according to the number of holes), a nesting form for the work, and an air-hydraulic booster to operate the punching units. An unusual feature of the set-up is that though the units are of simple single-acting construction, actual operation is in two directions. When hydraulic pressure is first admitted to the unit, the piston moves toward the work, bringing a die into contact and holding it securely against the nesting form.

As the forward movement ceases, pressure increases within the cylinder, causing the cylinder to move away from the piston against spring pressure. To the cylinder of the unit is

OPEN THE WAY TO GREATER PROFITS

BY USING S & S HINGES

ANY SIZE—ANY STYLE—BUTTS AND CONTINUOUS LENGTHS—*for* GUARDS—CABINETS—CASES—BOXES
WRITE FOR CIRCULAR
S & S MACHINE WORKS
HARDWARE DIVISION
4539 WEST LAKE STREET CHICAGO, ILLINOIS



TURNER GEAR BOX DRIVE

for Brown and Sharpe AUTOMATIC SCREW MACHINES

Built for lathes, shapers, radial drills, turret lathes, vertical mills, etc.

This drive can be furnished for sizes 00, 0 and 2—both standard and high-speed types (six sizes in all.) Very compact, quiet and efficient individual drive. Six speed silent sliding gear transmission built especially for Brown & Sharpe Screw Machines. Quick change of pulleys gives unlimited speed range. Anti-friction bearings throughout. All steel, heat-treated gears running in oil. Can be installed without drilling in one hour.

DEALERS: Write for prices and literature!

USERS: See your dealer or write for full facts!

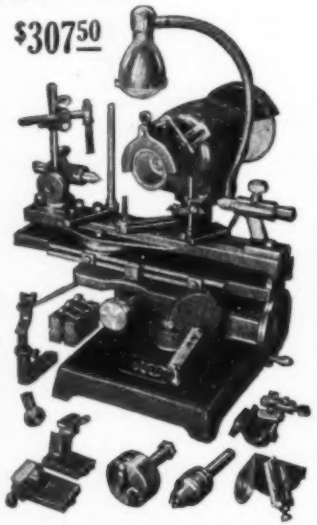
PATENTS PENDING

THE TURNER UNI-DRIVE CO.
1638 Central St., Kansas City, Mo.

KO KNOCK-OUT Reamer and Cutter Grinder

Here is one machine that is still within the range of your pocket book.

$307.50



Outstanding! Why?

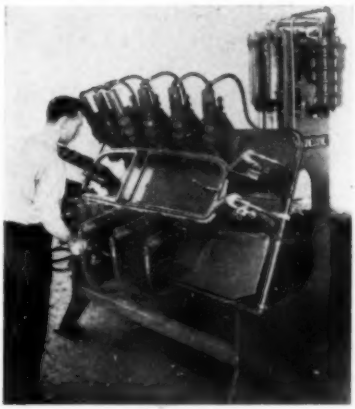
At the astonishingly low price of $307.50 you can buy this Universal Tool that will do any kind of a tool sharpening job encountered in the average shop such as milling cutters, reamers, taps, end mills, metal slitting saws, carboloy bits, etc. And what is most important of all, you can do the work in approximately one half the time required on large machines costing from 3 to 5 times as much. Even if you have a Universal cutter grinder now, you cannot afford to tie up a big expensive machine for the average small sharpening job.

This machine is so simple and easy to operate, and involves such a nominal investment, that it is economical to install one in each tool crib instead of routing all sharpening jobs to one main tool room.

The K-O Grinder can be used to advantage in many manufacturing operations. It is easy to attach special holding fixtures. The machine can be purchased without attachments if desired. *Ask for bulletin RG-39-H.*

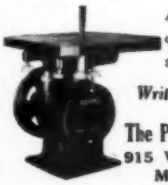
K. O. LEE & SON CO.
Aberdeen, So. Dak.
KO KNOCK-OUT
"practical tools for practical men"

connected the punch and counterpunch, which, thus, pierce the work from the far side.



In operation, hand clamps at each end of the nesting form position the work until the operator presses the starting button, which brings the die of each punching unit into contact with the work under low (90 lb.) hydraulic pressure. Immediately the dies contact the work, clamping it securely in the nesting form, the resulting back pressure trips the main pressure switch bringing the hydraulic booster into full action to complete the punching.

$25 BUYS A POSTEL DIE FILER
(*f. o. b. Minneapolis*)



A dependable, precision tool that will soon pay for itself.

Write for full information

The Postel Filing Mch. Co.
915 Washington Ave., So.
Minneapolis, Minn.

Talide Metal

Tungsten Carbide applications will be broadened by the development of Talide Metal—product of Metal Carbides Corp., Youngstown, O.

Aside from hardness, resistance to abrasion and other familiar characteristics of the sintered Carbides, Talide is available in almost any length, diameter or size and in all practical shapes such as strips, rods, bars, tubes, rings, etc.

In the past, it was possible to obtain the Carbides only in comparatively small pieces. Now single pieces are being produced that weigh 100 pounds or more. Even larger pieces can be made as required.

Extra large dies for drawing and forming flat sheet metal, steel and non-ferrous cylinders and shells are being made of solid Talide, in sizes as large as 8" in diameter. These dies are said to produce a superior finish, maintain closer tolerances and extend service life over that delivered by hardened steel dies.

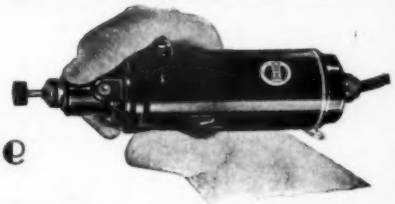
Strips, rods and bars of Talide are supplied for a variety of wear-resisting applications in single lengths of 16", 24", 48" and longer. Tipping working surfaces of centerless grinder support blades is a frequent application. Other types of wear strips are used extensively in the manufacture of razor blades, springs, bolts, spark plugs, zippers, etc.

Special shaped forming dies and punches for compressing powdered iron parts, bronze bearings and ceramics are recent developments.

Burnishing rollers of solid Talide, polished to a high lustre are effective in removing tool and wheel marks from turned or ground work.

Recommendations will be given on individual wear-resistance problems.

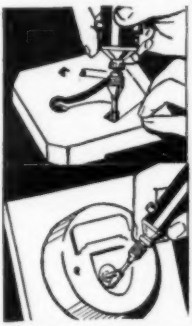
Insist On The Genuine



MOTO-TOOL

EXTRA SPEED (27,000 r.p.m.) and EXTRA POWER

—for all variations of work from hairline precision work to power jobs.



No other motor-in-hand tool of its size and weight has such reserve power and speed, such ease of handling as Moto-Tool. Its compactness enables you to get into places you can't reach with ordinary tools; its 13 oz. weight and vibration-less finger-tip balance allow precision work without the delay of removing and resetting larger tools. It does in minutes what ordinarily requires hours; it pays for itself over and over, week after week, month after month. And it *stands up* under severe service: It has oil-less (oil-sealed) bearings, over-sized hardened shaft and built-in cooling fan; motor armature dynamically balanced to eliminate vibration. Moto-Tool handles over 200 accessories; operates on 110 volt A.C.—D.C. Sold by better dealers, or order direct. Catalog FREE.

MASTER MODEL Only $16.50 Postpaid

Kit With 23 Accessories $23.50

DREMEL MFG. CO.
Dept. 210-B
RACINE, WIS.

100 TOOLS in ONE

GRINDS — CUTS — ROUTES — SAWS — POLISHES — SHARPENS — SANDS

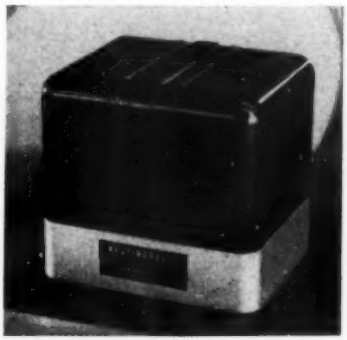
Announcing
AN ADUSTABLE DEPTH
COLLET CHUCK
BY UNIVERSAL

No tang or taper required. Uses broken or whole drills. Adjusts to within .002" to .003". Write for facts.

UNIVERSAL
Engineering Company
Frankenmuth, Mich.

Compact Photoelectric Relay

A new compact photoelectric relay which can be used for counting, sorting, weighing, measuring, signalling, and similar functions, has just been announced by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.



Designated as the type RQ Photo-Troller, this device is especially designed for low operating expense, low initial cost, and ease of installation. It has two normally open and two normally closed contacts, each rated at 10 amperes on 115-volt a-c circuits. It operates on a change of 40 foot-candles, if not more than 15 foot-candles of extraneous light is present.

Increased sensitivity is obtainable by means of a condensing lens. The unit may be wall or bench mounted with open wiring, or with concealed or exposed conduit. It has a gray die-cast chassis with a block molded cover which is removable without tools.

SAVE 80%
On Hack Saw Blades

Regrind each blade 4 times. Price of $15.75 includes one grinding wheel.

C. H. CARLSON MFG. CO.
13-15 Main St., N. E. Minneapolis, Minn.

Plated Aluminum

Two new prefinished bonded metals — nickel aluminum and chrome aluminum sheets are announced by the American Nickeloid Co., Peru, Ill.

These are formed by a surface of chromium or nickel bonded by an electrolytic process to an aluminum base metal, using the Krome Alume process patent No. 1,971,761.

Exhaustive tests over a four year period have convinced the makers that the process gives coatings that will not peel.

In one of these tests, two pieces of nickel aluminum were soldered together. In pulling or twisting the joints, the solder ruptured with no indication of any peeling of the nickel coating.

Because the aluminum does not have to be etched to obtain a bond, the lustre of the plated surface is not dulled.

While the Company is not equipped to plate formed parts after fabrication, the process has been used satisfactorily on aluminum-chromium utensils.

The new prefinished sheets are available in sizes up to 36"x96", in a full range of tempers, and in gauges from .010 to 064". A choice of bright or satin finish and striped, crimped or corrugated patterns adapts these new prefinished metals to many uses.

It is claimed that both metals are easily workable during manufacturing processes, and are highly resistant to corrosion or tarnish. They can be bent, stamped or moderately drawn without damage to the coatings which are guaranteed not to lift or peel from the base metal.

-A
New
ROTARY
MAGNETIC CHUCK
Permanent Magnet Type
— No Electric Current
required . . . . . Permanent magnets
have strong holding power — last indefinitely
. . . . . Unusual convenience and economy —
No wires — No heating — No running costs
—Ask for circular on Rotary and Rectangular Models
Brown & Sharpe Mfg. Co., Providence, R. I., U. S. A.
BROWN & SHARPE

Portable Electric
"BUDGIT" HOISTS

NO MOVIES FOR THIS MAN TONIGHT!

After dinner he sleeps . . .

No movies! No play with the children! Just dinner — then sleep in the chair. He spent much of the day lifting energy-sapping, muscle-straining loads . . . Why? Simply because his employers do not know about "Budgit" Hoists — small portable electric hoists that take all physical effort out of lifting and do it faster and at lower cost.

"Budgit" Hoists come in 250, 500, 1000, and 2000 pounds lifting capacity with speeds to suit *today's* tempo . . . They have all features you expect in modern electric hoists yet weigh so little it *is* practical to move them from job to job . . . Prices start at $119 and, there is nothing else to buy before you can use them. You simply hang up, plug into any electric socket, . . . and Use!

Send for catalog containing complete information, also "Time Savings Calculator" that shows savings they earn.

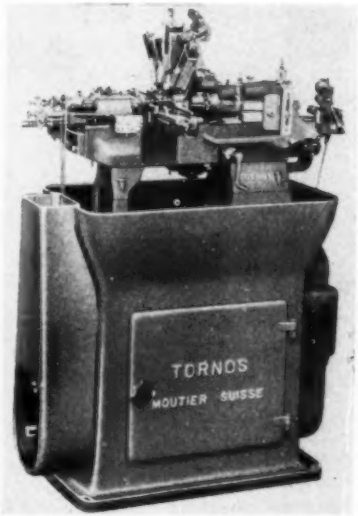
SHAW-BOX CRANE & HOIST DIV.
MANNING, MAXWELL & MOORE, INC.
435 Broadway • MUSKEGON, MICH.

Makers of all types and sizes of Electric and Hand Operated Cranes and Electric Hoists . . . Send all your crane and hoist inquiries to "Shaw-Box"!

Hang Up, Plug In, USE!

Tornos Offers New Models

The George Scherr Co., Inc., 122 Lafayette Street, New York City announces a new, improved Swiss automatic screw machine, manufactured by Tornos, one of the largest screw machine manufacturers in Switzerland.



The line comprises seven models with spindle bores to take bars from 5/32" to 1 3/16" in diameter. The headstock feeds longitudinally on the bed for a distance corresponding to the length of the work. Five simple turning tools are arranged radially around the bar stock. The latter is held in a rapidly rotating spindle in the headstock and is fed forward past the turning tools. In order to turn different diameters, shoulders, tapers or to generate forms of any kind, the tools move in and out by cam motion. No box or forming tools are employed. Spindle speeds up to 12,000 r.p.m. are possible. Tool setting is done by means of patented micrometer screws on which backlash is taken up by spring pressure. This

POLISH YOUR STAINLESS STEEL SHEETS BY THE EXCELSIOR PATENTED PROCESS.

SAVE 75% OF YOUR POLISHING EXTRA.

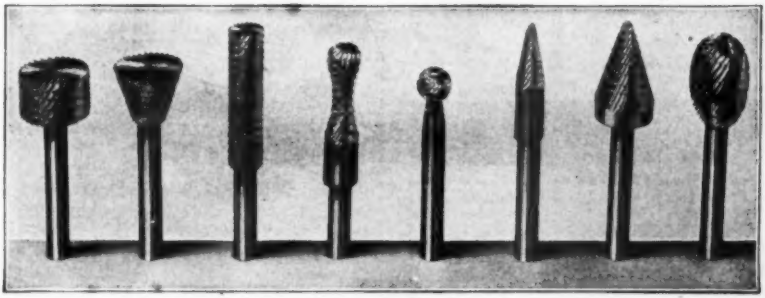
SAVE TIME AND QUANTITY EXTRA COST.

SATIN, MIRROR, No. 4 & 7 FINISH ARE OBTAINABLE ON ONE EXCELSIOR MACHINE.

Write for particulars to the

EXCELSIOR TOOL & MACHINE CO.
EAST ST. LOUIS, ILLINOIS

FORD GROUND CUTTERS



Just a few of the many standard shapes which are carried in stock.

Write for full information.

413 PERSHING AVE. **M. A. FORD MFG. CO.** DAVENPORT, IOWA

is claimed to assure lasting precision and securely locked tool adjustment.

Tornos automatics are particularly suitable for producing long, thin work, fine shafts and delicate pivots requiring great accuracy and fine finish. It is stated that accuracy limits within .0002" can be maintained. Second operations by means of bench lathe, burnishing machine, etc. can generally be eliminated with a corresponding saving in costs. All models are available with five turning tools.

A new catalog pointing out numerous Tornos applications and showing samples of work, will be mailed on request.

A motion picture of a Tornos automatic in actual operation has been produced for loan to associations interested in screw machine work and for groups of plant executives who may wish to determine how the Tornos can be applied to their own screw machine problems. The film may be used on any standard 16 mm home movie projector and may be obtained without cost or obligation upon application.

SAY THAT AGAIN— I CAN'T HEAR YOU!

"This Factory Noise Is Deafening"

• Noise interference causes costly phone errors. This new doorless booth has an acoustic lining. It blots up noise. It makes an island of quiet in the noisiest places. You hear distinctly. Calls are made faster, without errors or shouting.

Patented

This Acousti-Booth Soaks Up Noise
Mail Coupon for Free Booklet

Please send Free booklet describing Burgess Doorless Acousti-Booth and how it makes telephoning easy in noisy places.

Name .....

Firm Name .....

Street-City .....

Burgess Battery Company, Acoustic Division
Dept. HM, 500 W. Huron St., Chicago
Operating Under Burgess Patents

BURGESS

ABRASIVE WHEEL DRESSERS

KEEP GRINDING WHEELS SHARP AT LOW COST. SPECIAL DRESSER FOR SURFACE GRINDER GIVES HEAVIER CUT WITHOUT BURNING.

SEND FOR CIRCULAR

M & S DRESSER
377 CORNWALL ST.,
HARTFORD, CONN.

Toughness and Strength

Power shovels at work have a tremendous fascination for most people, judging by the crowds that gather to watch them. Operation is so smooth and effortless that it is a question whether the watchers appreciate what they are seeing—a combination of mechanical strength and mobility, the equal of which it is hard to find in mechanized equipment.

Power shovels have reached their present stage of efficiency because manufacturers have paid unflagging attention to design and the selection of materials.

The subject is discussed in the current issue of the Moly matrix, published by the Climax Molybdenum Co., 500 Fifth Ave., New York.

A typical case is cited of a shovel manufacturer who is using Molybdenum steels for many vital parts. A total of 15 parts are of Molybdenum steels.

One part that must withstand heavy loads and severe operating conditions is the drive mechanism for the shovel crawler. The shovel weighs 87,000 lbs., and can be propelled at two speeds—1½ m.p.h. for ordinary travel and ¾ m.p.h. when the going is hard.

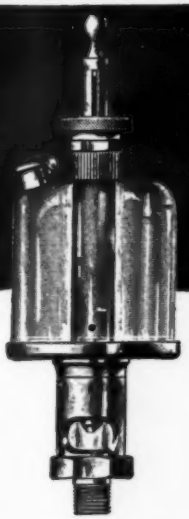
Details of the chemical analyses and physical characteristics of the steels used for this and other parts of the shovels are given—also heat treatment.

A natural conclusion is that steels which stand the stress and strain of excavating service, will answer almost any requirements.

The makers claims for Molybdenum steels include high strength which permits relatively small section, plus an exceptional combination of toughness, ductility and fatigue strength. Machinability in the heat treated condition helps to keep fabrication costs down.

A helpful book "Molybdenum in Steel" will be sent on request.

OIL when and as you need it!



GITS

unbreakable
SIGHT GRAVITY
NEEDLE VALVE
ADJUSTMENT
FEED OILER

Oil flow may be adjusted as desired, or completely shut off by adjustable needle valve. Modern, streamline, unbreakable bottle eliminates danger of broken glass in production.

Complete details on request.

GITS BROS. MFG. CO.

29 years of oil cup experience

1860 South Kilbourn Ave. Chicago, Ill.

The "Butterfly"

Filing and Die Making Machine

Reg. U. S. Pat. Off.

NEW MODELS D. & E. L.

The "Butterfly" owes its ever increasing popularity to its high standard of efficiency. It is the quietest machine of its kind and is well adapted to highly accurate work. It is being used by the leading manufacturers of the United States and Europe and also by the United States Government.

Constructed as per specifications of United States Navel Aircraft Factories.

Be sure of Imitations!

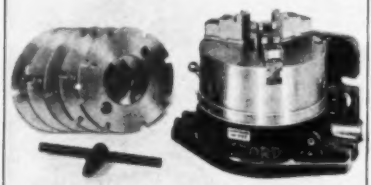
Our machine carries the Butterfly trade mark.

Write for folder D. and E. L.

HARVEY MANUFACTURING CORP.

161 Grand St., New York, N. Y.

FOR MILLING, DRILLING, SLOTTING, OR PLANING



FOR ONE PIECE— —OR FOR THOUSANDS

The HARTFORD "Super-Spacer" indexing fixture was designed to meet the demands of modern feeds and speeds. Its unequalled versatality fits it equally well for special work or for production jobs. Quick set-up—rapid, accurate indexing—elimination of error—greater rigidity—all these are yours in this new device.

Send today for complete information.

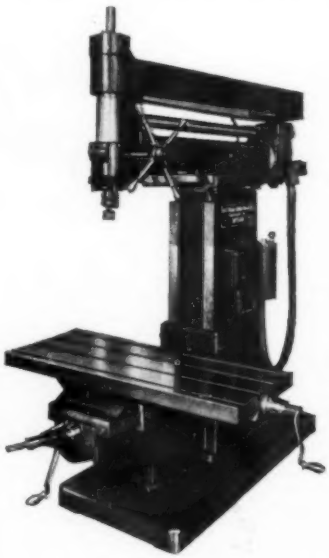
Hartford Special Machinery Co.

285 Homestead Ave., Hartford, Conn.

Ekstrom, Carlson No. 540 Is a Versatile Unit

Increasing demand from important pattern shops, aircraft factories, and metal working industries is responsible for development of the new No. 540 Universal Milling, Drilling, and Routing Machine.

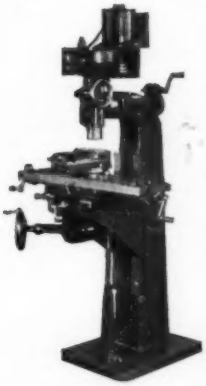
The makers emphasize the versatility of the new machine with the assertion that it can handle practically all types of work. Jobs which are now being done on this machine include pattern and core box work, grooving, drilling, milling, routing, trenching, jointing, gear cutting and many other applications. Every cut



made on the No. 540 is said to be accurate within the closest limits. The machine is particularly adapted to work in pattern shops, aircraft factories and in metal working plants where there is considerable cutting of the softer metals such as duraluminum, brass, copper, aluminum, etc.

Index Mills Pay Greater Dividends

Considering the Investment than Any Machine You Can Put In Your Tool Room—



No. 39 Mill

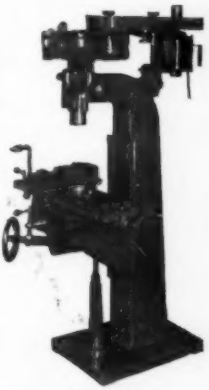
No. 39 is a thoroughly modern high speed vertical, indispensable on tools, dies, jigs and fixtures. Mills and drills a die 8"x15" at one setting. Uses end mills up to ⅝" in tool steel. Has No. 9 B & S taper in ball bearing spindle. Six speeds, 375 to 2820 r. p. m. Swivel head controlled by worm and worm gear. 3¼" spindle travel.

No. 40 is the same as No. 39 basically, with equipment added making it a combination Mill and Locator. Verniers cross and longitudinal. Infinite speeds from 100 to 2820 r. p. m. Uses end mills up to ¾" and bores 3" holes.

You cannot afford to neglect investigation. Write TODAY to:

BLANK & BUXTON MACHINERY CO.

JACKSON, MICHIGAN



No. 40 Mill

Introducing

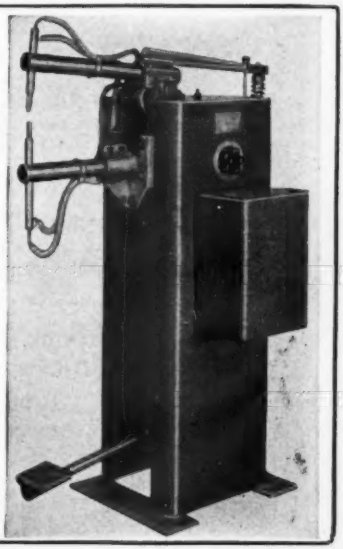
A New ACRO Welder

Light Duty—
Floor Type—
Foot Operated—

ACRO offers a line of light duty dependable and efficient foot operated Resistance Welders ranging from 5 k v a to 20 k v a.

Larger capacities in foot operated machines, as well as Air and Hydraulic Operated are available.

For further information on our complete line send postal or letter.



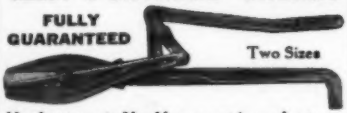
Acro Welder Mfg. Co.

1570 S. First St., Milwaukee, Wis.

ALL ALLOY **PORTABLE SHEARS**

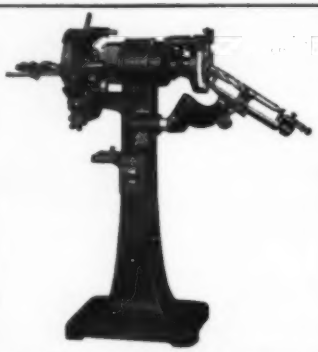
FULLY GUARANTEED

Two Sizes



No. 1 cuts up to No. 11 gauge strip or sheet.
No. 2 cuts up to ¼" steel plate.
Special Blades for shearing stainless steel.

BREMIL MFG. CO.
1720 Pittsburgh Ave., Erie, Pa.



STYLE 10-B GRAND RAPIDS
COMBINATION TAP & DRILL GRINDER
SHARPENS TAPS FROM No. 6 TO 1½" TWIST DRILLS FROM ⅛ to 1½".
BULLETIN ON REQUEST

Gallmeyer & Livingston Co.
486 STRAIGHT AVE., S. W., GRAND RAPIDS, MICH.

The spindle can be tilted 90 degrees in either direction or a complete swing of 180 degrees.

A 33" maximum throat clearance enables the operator to handle work of large size. The machine has a clearance of 24" from the spindle chuck

in its highest position to the top of the table in its lowest position. The table on the No. 540 is 18" x 48" and is constructed with four T-slots and a carriage is provided to tilt the table 30 degrees in either direction. Longitudinal table movement is 30"; transverse movement is 16"; the vertical adjustment is 24", giving ample room for all work. Table is constructed with micrometer adjustments.

Address Ekstrom, Carlson & Co., Rockford, Ill, for a full description, together with information and illustrations of cutters which may be used.

TAYLOR "HI-EFF" STATIC BALANCING MACHINES
For Workpieces 2' to 90' Diameter

Balance the Product
EASIER, FASTER AND MORE ACCURATELY
Fans, Wheels, Clutches, Grinding Wheels, Tires, Castings, etc.

TAYLOR SALES COMPANY
2330 W. CLYBOURN ST. MILWAUKEE, WIS.

NOW NEW

BALL BEARING MODERN MOTOR DRIVES

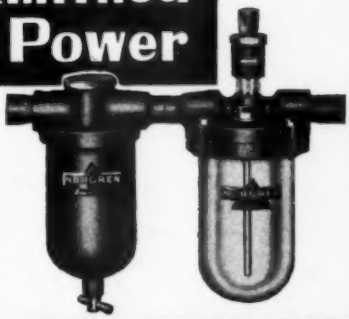
Be prepared for increasing production. Be independent of machine tool scarcity. You can bring *old* machines to *new* standards of production—increase efficiency of machines and operators by replacing line shafts with Modern Motor Drives—now BALL BEARING EQUIPT to make better use of power.

Modernize with Modern Motor Drives!

With simple positive crank and dog cam adjustment operators automatically tighten belts to proper tension to *take bigger cuts, save time — save power.* Write for complete information and prices.

QUALITY HARDWARE & MACHINE CORP.
5849 NORTH RAVENSWOOD AVE., -:- CHICAGO, ILL.

Streamlined Air Power

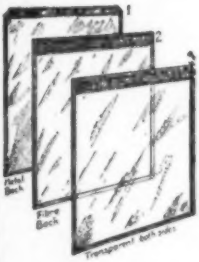


Give your pneumatic tools streamlined air power—air that's cleaned of grit, scale and moisture—air that carries an oil fog to lubricate the tool. Norgren Vitalizer Unit does the trick—cuts oil and repair costs 75%—improves tool and operator efficiency. 50,000 in use. *Ask for circular.*

C. A. NORGREN CO., INC.
214 SANTA FE DRIVE DENVER, COLO.

CUTS PRODUCTION COSTS

Protect **Shop Orders, Drawings, Blueprints...**



with

WADE Shop Envelopes

Any size or style to order, stiff or flexible, to suit your requirements.

Send for folder and quotation.

WADE INSTRUMENT CO.
1422 E. 109th St., Cleveland, O.

AMES BENCH LATHES

Precision lathes for doing most accurate turning, drilling, milling, threading, filing, polishing, in the tool room or in production.

Send for Complete Information

B. C. AMES COMPANY
WALTHAM, MASS.

Lincoln Offers New Small Welder

A new 200 ampere arc welder of the Lincoln Junior type with a range for many welding applications ordinarily associated with considerably larger welding equipment, is announced by The Lincoln Electric Co., Cleveland, Ohio. This new machine, because it is of motor-generator D. C. arc type, will weld virtually all metals and alloys and do hard facing work, according to the manufacturer. Its speed of operation and quality of results are reported to be exceptionally high for work of all sizes, under all operating conditions.

The new welder is single-operator, variable-voltage type and can be used with bare or shielded arc type electrodes. It has a current range of 60 to 250 amperes for welding duty.

A special feature, original on small arc welding machines, is Lincoln's patented dual continuous control. This permits independent adjustment of voltage and current, giving complete

"Bill, why don't we use Cerromatrix?"

"Sure, you've heard of it — that low-temperature-melting alloy that expands slightly on solidifying. Great for securing punch and die parts without fitting and filing, or stationary machine parts without costly drive fits. Many shops around here make big savings with Cerromatrix. Heard of one today that saved 500 hours on a lamination die. Look into it, Bill. Maybe we can save with Cerromatrix, too."

Send for the new free Cerromatrix Manual.

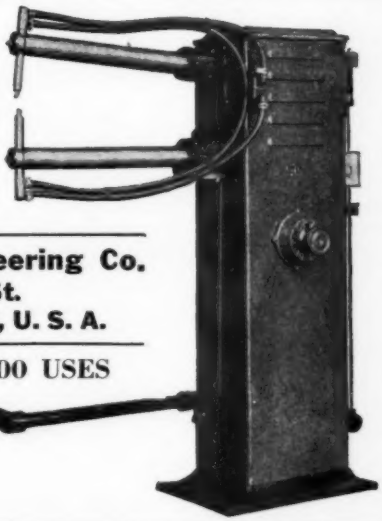
CERRO DE PASCO COPPER CORPORATION

44 WALL STREET • • • • • NEW YORK, N. Y.

BRITISH ASSOCIATES: **— MINING & CHEMICAL PRODUCTS LTD., LONDON, ENGLAND**
CANADIAN REPRESENTATIVES: **— DOMINION MERCHANTS LTD., MONTREAL, CANADA**

DYER SPOT WELDERS

from
2½ KW to 35 KW
Bench and Floor Type



Dyer Welder & Engineering Co.
2727 Walnut St.
Kansas City, Missouri, U. S. A.

THE WELDER OF 1000 USES

For Sheet Metal
and
Wire Products

Essex

The makers of a complete line of lubricating devices since 1901.

Send for catalog.

ESSEX BRASS CORP.
2000 Franklin St., Detroit, Mich.

and separate control of arc heat and arc penetration.

Use of Class B insulation at proper points enables the unit to withstand sustained overloads. The coils, wound with glass-covered wire, are held in mica-lined slots separated by mica dividers, and leads are connected into the commutator by special high-melting-point solder. End turns are insulated with mica tape.

The motor is the "Linc - weld" squirrel-cage induc-type for across-the-line starting. Connections are readily available for 220 or 440 volts (also supplied for 550 volts or special voltage); 3 or 2 phase; 60 cycles.

Construction is of arc welded steel. Four steel feet are welded to the base and drilled for bolting in permanent position, or for attaching of 3-wheeled running gear, which is optional. The welder occupies less than 4 square feet of floor space. A lifting lug facilitates crane handling.

LEAKPROOF AIR VALVE
Saves Air - Low Maintenance
Positive Air Control with Ease

MADE OF BAR BRASS and STAINLESS STEEL

A Marvel of Simplicity

No packing glands. No external buttons or levers. Leakproof. Controls air with matchless efficiency from slight discharge to full blast with slight pressure between thumb and finger. All operating parts enclosed. THOUSANDS IN USE IN LEADING PLANTS. Order sample on 30 days approval.

Only Air-O-Chek Valves have the enclosed actuating lever connected to valve by ball and socket joint.

AIR-WAY PUMP & EQUIPMENT CO.
[illegible] WEST JACKSON BLVD. CHICAGO, ILLINOIS

Hallowell—Unbrako Expansion

To provide more adequate facilities for steel storage, etc., the Standard Pressed Steel Company, Jenkintown, Penna., makers of Hallowell Shop Equipment and Unbrako Socket Screw Products, are commencing the erection of a 12,000 square foot addition to their main plant. The new structure is of steel, brick and glass construction and modern in every detail.

A Light For Every Machine Tool

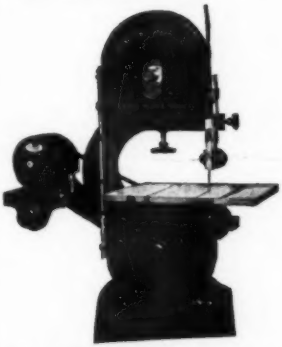
Vimco Lights are specifically designed for machine tool illumination. Vimco is standard equipment with many of America's leading manufacturers.

Vimco offers a complete line of lights, with types, sizes and equipment for all kinds of machine tools.

The illustration shows a Hall Mfg. Co. Grinder equipped with a Vimco Light. *Write today for more information.*

VIMCO MFG. COMPANY, Inc.
199 Chenango Street, Buffalo, New York

RACINE Duplex Band Saw



Two Speeds — for cutting wood, steel, brass, copper, tubing, angles, templates.

The ideal all around machine for production shops, tool rooms, pattern shops, laboratories.

Accurate—Fast—Rugged. Modern, High Grade Construction.

"Standard the World Over"

RACINE TOOL & MACHINE COMPANY

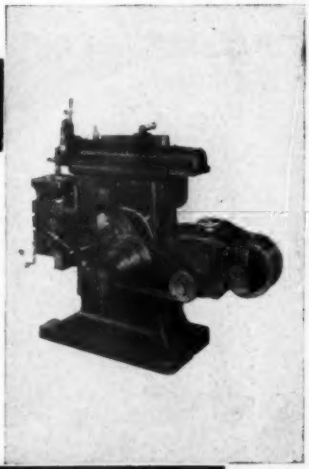
1754 STATE ST. -:- RACINE, WIS. U. S. A.

Modernize with

FLEXOID SPEED CONTROL

A Revolutionary 4 Speed Control Unit

The Flexoid 4 speed control combines all the advantages of motorized control for machine tools in one compact, fool-proof, self-contained unit. A single hand control —at remote position if desired—operates all ratios with neutral position between changes. All hardened gears... ball bearing ... parallel input and output alloy shafts... rigid, solid construction ... all housed in one case ... motor mounted on unit. Write for descriptive data and prices.



The Smith Power Transmission Co.

410 LAKESIDE AVE., N. W., CLEVELAND, OHIO

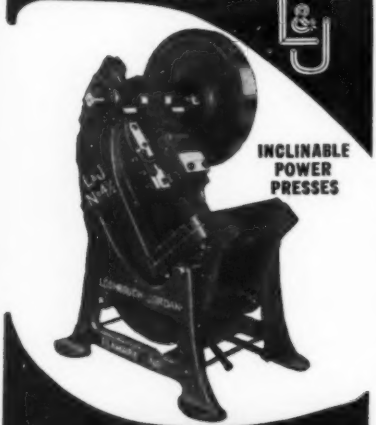
3 NEW
CIRCULAR TABLES

10 inch, 12 inch, and 15 inch diameter; substantially constructed to provide years of high precision service. Write for Gorton Accessories Catalog and learn more about these *extra-value* tables.

GEORGE GORTON MACHINE CO.
1115 13TH STREET
Racine Wisconsin

Standard Since 1911

L&J



INCLINABLE POWER PRESSES

LOSHBOUGH-JORDAN TOOL & MACHINE CO.
1625 STERLING AVE ELKHART, INDIANA

Ryerson Introduces "Sloppy Sam"

The quaint character pictured has proven a painless, effective solution to one of Industry's paramount operating problems — that of promoting safety and efficiency through plant cleanliness.

"Sloppy Sam" is the unkempt gentleman's name, and he's a brain-child of the Plant Inspection Committee in the Buffalo, N. Y. steel service plant of Joseph T. Ryerson & Son, Inc. Sam is given lodging in departments proclaimed sub-standard by the Committee during their weekly inspection tours. His visits evoke good natured chiding from members of other departments who in turn make a definite effort to keep their departments clean so the unwelcome visitor will have no reason to call on them. The results of this humorous approach to the cleanliness problem were so favorable that duplicates of Sam were made for the Company's other plants. The figures are flame-cut by Ryerson from rolled steel plate and painted in bizarre colors.

A New Flame-Hardening Process

A higher degree of hardness in steel and alloy iron rolls, mandrels, etc., is

STANDARD FAVORITES Belonging in Your Shop

Fig. 732
Pat'd and
Pat's Pending
Drawer is extra

"HALLOWELL" STEEL WORK-BENCHES

They're indestructible and provide lifetimes of smooth, rigid, splinter-free surface ideal for precision or heavy work. Standardized construction permits easy movability. 1367 styles and models available right from stock to meet every requirement and costing less to buy than to build wood makeshifts. *Write for our catalog.*

"HALLOWELL" STEEL TOOL STANDS

Goes right to the job—keeps tools handy and in order. Many models to choose from. *Write for details.*

Fig. 705

STANDARD PRESSED STEEL CO.

BRANCHES BOSTON DETROIT INDIANAPOLIS

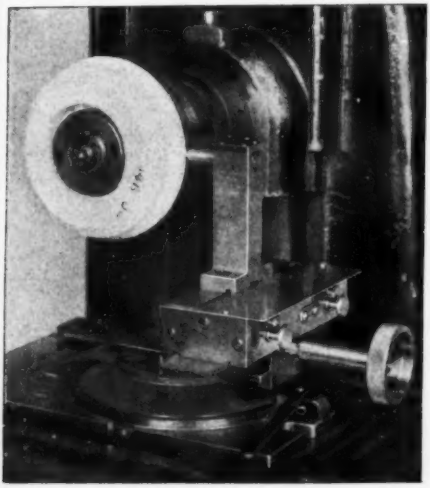
JENKINTOWN, PENNA.

Box 559

BRANCHES CHICAGO ST. LOUIS SAN FRANCISCO

The VINCO

Angle Tangent To Radius Dresser For Internal, External and Surface Grinding Machines



Patented June 5, 1934.
Other patents pending.

U. S. S. OF RUSSIA

From the land of the Soviets comes another repeat order for nine Vinco Dressers. This dresser is standard equipment in many Russian factories, and its merit so well known that the logical sequence is the purchase of more dressers to meet the needs of their rapidly expanding industries. The very fact that this dresser has the basic patented principle of dressing angles and radii from the same axis without moving the diamond makes it the only dresser that can dress angles and radii accurately, economically and tangent on abrasive wheels. Index Plate and Vernier are graduated on a Vinco Master Dividing Head to a one ten thousands of an inch accuracy. All parts subject to wear are hardened, rough ground, seasoned, finish ground and lapped. It is a permanent tool and will last a life time. It saves 75% in dressing costs, eliminates all worry and uncertainty and is fully guaranteed to be satisfactory.

Send for Descriptive Circular

Vinco Tool Company
7348 Central Ave., Detroit, Mich.

said to be obtained by a new flame-hardening process developed by Linde Air Products Co., and in operation at the plant of Farrel-Birmingham Co., Inc., Ansonia, Conn.

It is known as the Vertical Combination Method. By using it Farrel-Birmingham claim they are able to raise the hardness of a 65-70 carbon steel cylindrical object to approximately 90 or better on the Type "C" Scleroscope. They have also tested the process considerably in hardening a special dry sand alloy cast iron known as "Farre-flame" and have obtained an average hardness of 80 on the Type "C" Scleroscope.

Another advantage claimed is absence of distortion. Overlap from the flame of the old progressive method of hardening is said to be eliminated because the new process is continuous. uses a large number of flame tips and is followed immediately by a water spray quench.

Full information will be furnished by Farrel-Birmingham Co., Inc, to interested executives and engineers who care to write to the company's offices at Ansonia, Conn.

VISE

With and Without Jig Attachments

For DRILL PRESS. Often Used on MILLER, SHAPER or PLANER

Fig. 1 With Jig Attachments

The Attachments mean much duplicate drilling without expensive jig making.

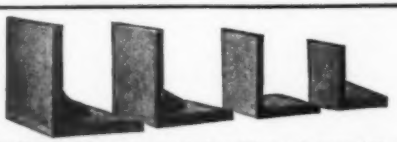
A simple single-purpose jig will cost more than the Vise, which will do many jobs.

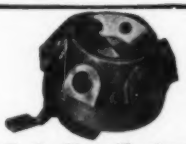
Remove attachments — Good Plain Vise.

Send for Circulars

THE GRAHAM MFG. CO.

70 Willard Ave., PROVIDENCE, R. I.





For Production tool up any lathe with our improved Turret Heads. They will cut cost and many tool changes. Also can be used on large turret lathes, single or multiple.

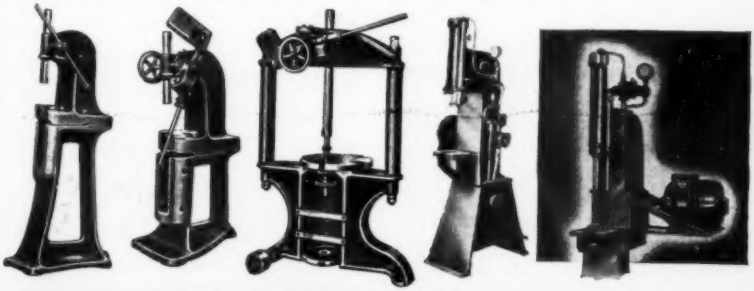
No. 1 3½" in diam. Sockets ⅝ x 1 in. deep.
No. 2 5½" in diam. Sockets ⅞ x 1½ in. deep.

Cast Iron Bench plates, six sizes. Cast Iron Angle plates, planed true, seven sizes.

Milliken Machine Co., - - - West Newton, Mass.

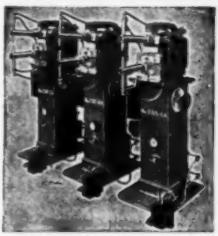
BROACH and ASSEMBLE

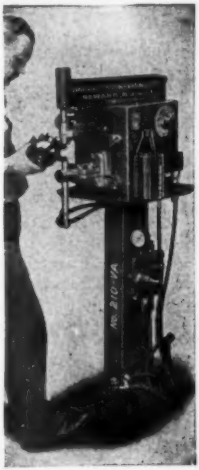
65 standard styles and sizes—manually operated presses from ¼ to 35 tons pressure—motor driven hydraulic presses from 1½ to 15 tons pressure. *Write for catalog F.*

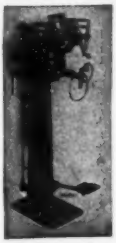


GREENERD ARBOR PRESSES

NASHUA Est. 1883 NEW HAMPSHIRE







Investigate our NEW VERTICAL PRESS TYPE WELDERS. Its something NEW for precision work. CHAS. EISLER has over 50,000 SPOT WELDERS in daily use, from ¼ to 500 KVA.

We also make standard and special TRANSFORMERS of all kinds.

WE INVITE CONTRACT SPOT WELDING IN LARGE OR SMALL QUANTITIES.

A. C. Arc Welders from 100 to 400 Amps.

Please write to us for more information.

Kindly mention Hitchcock's Machine Tool Blue Book.

CHAS EISLER

EISLER ENGINEERING COMPANY

762 So. 13th St. (Near Avon Ave.) **Newark, New Jersey**

WIRE GRIP
BELT HOOKS
Held in position by patented aligning cards to prevent waste—every hook can be used. Protects fingers. Applied with any standard Belt Lacing Machine.
STEEL GRIP
BELT LACING
for all power and conveyor belts. Clinches smoothly into belts, compresses ends, prevents fraying. 2-piece hinged rocker pins. Raises. In boxes or long lengths.

ARMSTRONG-BRAY & CO.

"The Belt Lacing People"

315 N. Loomis St., Chicago, U. S. A.

DESMOND

GRINDING WHEEL DRESSERS & CUTTERS

We manufacture the only complete line of Dressers and Cutters. Write for catalog and name of your nearest dealer.

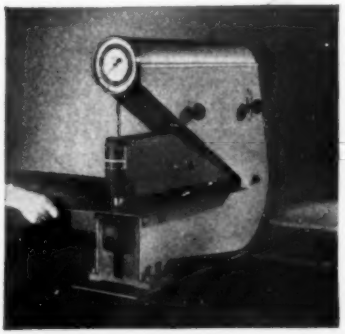
DESMOND-STEPHAN MFG. CO.

URBANA, OHIO

Canadian D. S. Mfg. Co., Ltd.
Hamilton, Ont.

Guyer Mechanical Micrometer

The Guyer Gauger is a mechanical micrometer designed for rapid, simple and accurate checking of the thickness or gauge of metal sheets. In operation the device clamps a sheet at any point where thickness is to be



measured. Work is held at this point long enough for the operator to read the large, legible dial. It is then automatically released for removal from the machine or to the next point to be measured. The cycle of clamping, gauging, and releasing is constantly repeated. The cycle frequency is under control of the operator. By following rhythm of the cycle, it is asserted that the operator can obtain readings in a fraction of the time required for hand "miking." The standard machine indicates from 8 to 38 gauge readings per minute, or any of the

Model 3 *Model 2* *Model 1*

BEVERLY SHEARS

Three sizes of BEVERLY SHEARS, offer you modern shearing performance.

Model B-1 weighs 16½ lbs.—cuts stock up to 14 gauge.

B-2 weighs 32 lbs.—handles up to 10 gauge.

B-3 weighs 55-lbs—takes up to 3/16" mild or 10 gauge stainless steel.

Reasonably priced—send for descriptive circular

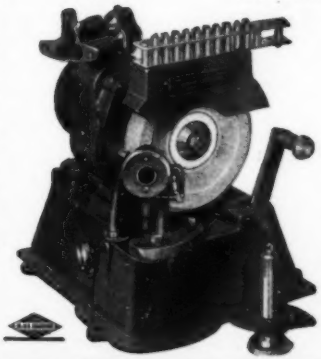
THE BEVERLY SHEAR CO.

3007 W. 110TH PLACE, CHICAGO, ILL.

Grind *Your* Drills On

"BLACK DIAMOND"

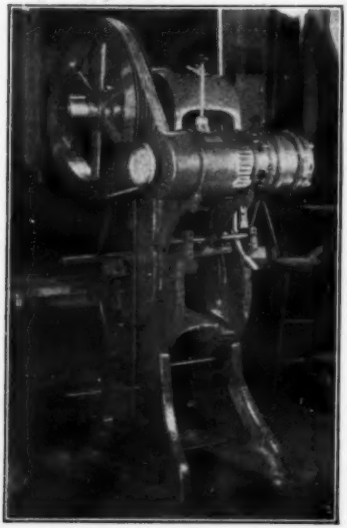
Precision Drill Grinder



Even an unskilled operator can do a precision job of drill grinding—handles sizes from No. 60 wire gauge to ¾"—easily, quickly and without any complicated adjustments. Saves time, drills and possible damage to the work.

Let us send you Bulletin No. 121-H.

BLACK DIAMOND SAW & MACHINE WORKS, INC.
NATICK, MASS.



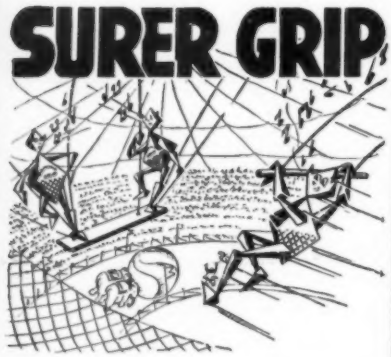
MORE PROFIT

Speeding up production . . . faster and more flexible operation . . . quicker, easier control . . . these are just some of the things you gain with Schultes 4-Speed Motorizing Equipment . . . and they all spell MORE PROFIT.

A Schultes unit will mean Finger-Tip Control on your punch press, lathe, milling machine, shaper, drill press, etc. Instant selection of just the right speed for the job . . . dependable, economical and durable units that are easily applied to all your machine tools.

Write for bulletin giving full details.

Westlof Tool & Die Co.
428 Bellevue Ave., Detroit



UNDER LESS TENSION

insures safe and spectacular performance. That's the kind of performance you can expect from your screw machines when they are equipped with Sutton DIAMOND-GRIP Collets. Their clean-cut diamond-shaped serrations grip tighter under less tension.

Ask for complete Sutton Catalog

SUTTON DIAMOND-GRIP COLLETS

SUTTON TOOL COMPANY
2895 W. GRAND BLVD. DETROIT, MICH.

Accessories for Screw Machines

following reading ranges can be supplied, if specified:—9—42; 10—47; 11—50 per minute. Throat of the machine is 23" deep, clear of the measuring anvil, which affords latitude in exploring wide sheets for uniform thickness.

The dial and measuring mechanism are carried by the two side members, so mounted as to eliminate errors due to deflection. The dial is graduated in 0.001" increments so that any desired gauge or tolerance may be established readily by means of adjustable dial rim markers. The dial tolerances represent the accuracy requirements of metal forming, drawing and stamping operations.

Address the Streeter-Amet Co., 4101 Ravenswood Ave., Chicago for bulletin giving full details.

A Welded Motor Mount

Virgil Rauch of Polytechnic, Montana, recently sent the accompanying photo to the Hobart Bros. Co., Troy, Ohio. His letter says:

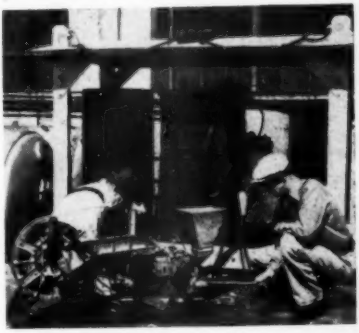
"The best way we could find to mount a motor drive on a small milling machine was to bolt a piece of truck frame to the side of the machine. This was strong enough for the weight but too flexible. To stiffen it, we welded on a piece of plate which made a closed box post. This proved successful and has been in use for over a year."

High-Speed Heavy-Duty Welding Progresses

Outstanding progress was made during 1939 in the use of high-speed, heavy-duty welding through a process developed by the Linde Air Products Co. It has brought about the use of welding currents ranging up to 2000 amperes in a single unit. This practice would have been considered not only impractical but impossible a few years ago.

A-c welders have been found to supply the need for this type of welding most efficiently and economically. The trend of development is to use 1000-ampere units with wide current ranges which may be operated singly or in parallel. For example, installations have been developed for using four 1000-ampere welders in parallel, which would provide for current ranges as low as 200 amperes and as high as 4800 amperes. All current adjustments are made without shifting any electrical connections, and are made under load.

It is said that the use of these welding methods has resulted in welding speeds, with attendant high quality, hitherto considered impossible. Consequently, welding has again demonstrated its value as an important factor in speeding up production in heavy fabrication.



NEW DeLuxe

It's a Real Buy

$45.00 Complete as Shown

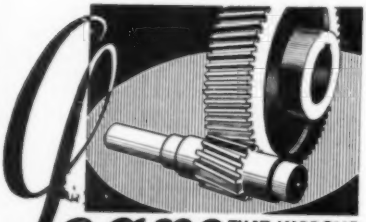
This New BALDOR Grinder has everything! Dynamically balanced rotor. Eye shields, tool light and 7"x1" ALOXITE Wheels made by Carborundum Co. ½ H. P. motor, 3400 R. P. M., 60 cycle. 2—YEAR GUARANTEE AGAINST BURN-OUT. Price comp. $45.00

GRINDER No. 714—it won't burn-out!

Write for BULLETIN 64 on COMPLETE LINE

BALDOR ELEC. CO.
4368 Duncan Ave.,
ST. LOUIS, MO.

BALDOR
BALL BEARING GRINDERS



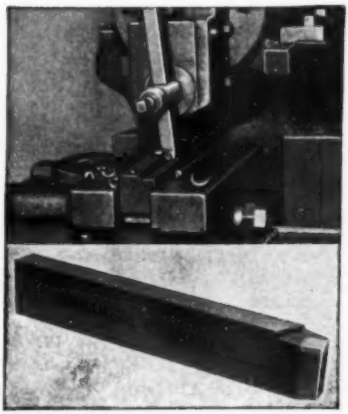
You will get longer life, better machine operation when you use Abart Cut Gears. They perform with ease, operate smoothly and without vibration, with each tooth engaging precisely at each revolution. No stocks. Made only to your B/P or specifications, delivered on time and at the right price. Consult our engineers on your gear problems and send specifications for estimate.

SPEED REDUCERS. Many types and sizes in stock for immediate delivery. *Write today for new catalog available.*

Abart GEAR AND MACHINE CO
MANUFACTURERS OF
Speed Reducers & Gears

Shaping Hardened Steels

McKenna Metals Co., 135 Lloyd Ave., Latrobe, Pa., announces standard steel-cutting shaper tools tipped with Kennametal grade KS, for use on shapers and planers to machine steel of hardnesses up to 550 Brinell. This is believed to be the first time that hard carbides have been regularly used on tools for shaping hardened steels.



Unusual tool angles are employed, namely:—10° negative back rake, 5° negative side rake, 15° side cutting edge angle and 2° clearances. It is emphasized that these tool angles, which must be maintained when regrinding tools for the best results, are made possible by the low frictional resistance between Kennametal and the work being cut. As a result, less frictional heat is developed than when high speed tools with conventional high side rake angles are used. It is pointed out that chips from Kennametal shaper tools are straw colored while those from high speed steel tools are a deep blue—using the same speed, feed and depth of cut in both instances. With these tool angles it is unnecessary to lift the tool on the return stroke. The illustration shows a typical tool, also a shaping operation performed at a rate in excess of 100 bt./min.

DIAMONDS
CAN'T COME
LOOSE!

CARBOLOY
DIAMOND DRESSERS
For Dressing All Grinding Wheels

Write for Catalog DR-38
CARBOLOY COMPANY, INC.
11139 E. 8 Mile Road, Detroit, Mich.
Chic.-Cleve.-Newark-Phila.-Pitts.-Worcester, Mass.

Kennametal shaper tools, it is stated, will shape steel of hardnesses above the machinable limit for high speed steel tools at speeds that are often double those used with high speed steel tools on work in the lower hardness ranges. Die blocks of 42 Rockwell C hardness may be hardened before machining with Kennametal, saving the grinding operation that would be necessary if they were hardened after shaping.

Kennametal KS is said to have a hardness of 76 Rockwell C with unusual strength, viz., 322,000 lbs. per sq. in. This combination of properties has made it practical to employ Kennametal-tipped tools for shaping and planing steel with results equal to those obtained when turning and boring steel with Kennametal. As in the latter case, they will take interrupted cuts without breakage and give longer service between re-grinds.

The sizes of tools furnished will fit standard clapper boxes of shapers and planers.

Noiseless Riveters

GRANT RIVETERS include both Noiseless Spinning and Vibrating Hammer types of machines—also Vertical and Horizontal Multiple Spindle Spinning Machines.

PIONEERS FOR OVER 35 YEARS

Send unriveted samples with request for recommendation and quotation.

THE GRANT MFG. & MACHINE CO.
C. E. Station
BRIDGEPORT, CONN.

A Real Welcome in

CLEVELAND

Add to every known hotel requirement, the traditional friendly attitude of our entire staff, then you not only have hotel comforts but an atmosphere of relaxation right in the center of a busy city.

ROOMS from $1.75

COLONIAL HOTEL

An Ideal Location at East 6th Street Between Euclid and Prospect
RANDALL M. LEWIS, Manager

MOORE'S SMALL SET SCREWS

Headless 2–56 to 1/2–13
Square Heads 6–32 to 3/8–16
QUALITY — Unsurpassed
QUANTITY — Capacity large enough to fill any order.

GEORGE W. MOORE
44 FARNSWORTH ST. BOSTON, MASS.
For 58 years manufacturers of quality screws.

Spot Welds with Seamwelder

Continuous automatic spot welding—using a seam-welder—is an innovation recently placed in operation in a prominent motor plant. It is said the operation is made possible largely by the the adaptation to a seam-welder of a standard Weltronic weld-timer which accurately controls length of time current is on and current is off, and provides an automatic repeating cycle.

Designed and built by Expert Welding Machine Co., Detroit, the machine makes accurately spaced spots, and by means of an adjustable timer control is enabled to adjust the size (length) of spots to the exact amount desired, irrespective of production rate.

Designed for series spot welding 19 gage oil baffle plates to 18 gage cover plates for both six and eight cylinder cars, the new welder includes a conveyor for carrying the work under the 'seam' rolls, a 50 KVA transformer, timer, contactor, etc.

The motor driven conveyor carries 10 short circuiting dies on which are

SUPERSET DIAMOND WHEEL DRESSER

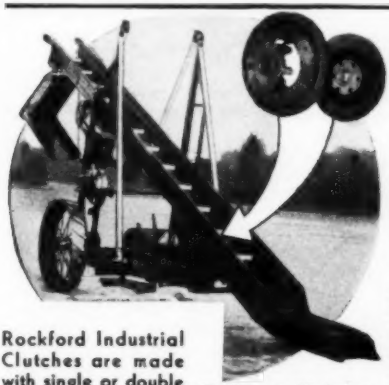
- ECONOMICAL—All Diamond Stones used completely up without loss or resetting.
- EFFICIENT—Several Cutting Points in contact with wheel at all times.

1-CARAT DRESSER 16 stones per carat for wheel Dia. 6" to 12"
2-CARAT DRESSER 12 stones per carat for wheel Dia. 12" to 24"
3-CARAT DRESSER 8 stones per carat for wheel Dia. 24" to 36"

Send for Circular and Prices!

METAL CARBIDES CORPORATION
YOUNGSTOWN, OHIO

-FAMCO-
ARBOR PRESSES
FOOT PRESSES
BENCH and FLOOR MODELS
Write for Catalog
FAMCO MACHINE COMPANY
1320 18th St. Racine, Wis.



Rockford Over-Center CLUTCHES Are "Top" Performers In Conveyor Service

An 8" Rockford Over-Center Clutch controls the power that propels, and operates the chain, in the conveyor illustrated . . . a hard life. Rockford O-C Clutches stand the gaff; operate easily and dependably.

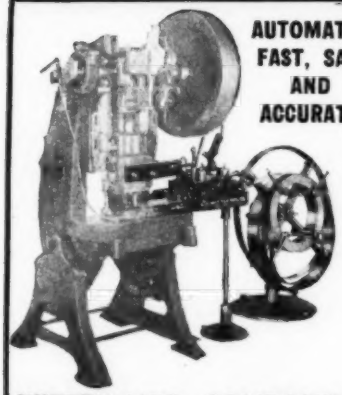
Rockford Over-Center Clutches lock in or out of engagement; Rockford Spring-Loaded Clutches work like an automobile clutch; both have many applications in many industries. Write for details.

Rockford Industrial Clutches are made with single or double drive plates, for operation in oil or dry, in sizes ranging from 6" to 20" diameter for transmitting from 2 to 80 h.p. at 100 r.p.m.

Pullmore Clutches with multiple discs and small diameters available for high speeds. Investigate.

Rockford Drilling Machine Division
Borg-Warner Corporation, 410 Catherine Street, Rockford, Illinois

WITTEK ROLL FEEDS
FOR ANY MAKE AND SIZE OF PUNCH PRESS



AUTOMATIC, FAST, SAFE AND ACCURATE

Wittek Roll Feeds are made in various models to meet any requirement in feeding all types of coil stock to punch presses.

Each unit is flexible in function and application capable of feeding stock in various thicknesses and widths up to the maximum width of the feed rolls and in lengths from 0 inches to 24 inches per stroke of the press.

Made in single roll, double roll, (push-pull) and compound models with built-in straightener to feed from right to left, left to right, front to back and back to front. Easily installed on any make or size punch press without alteration.

Wittek Automatic Roll Feeds provide a new and simple method of *automatic* feeding. They combine high speed and accuracy with low operating and maintenance cost, save dies, reduce scrap to a minimum and make automatic feeding practical on short runs.

WITTEK REEL STANDS

6 models—a reel stand for every purpose. Handles any size of type coiled stock, even steady run of stock to the feed and assures maximum production by eliminating looping, tangling and backlash.

Write for Catalog and Free Trial Offer

WITTEK MFG. COMPANY
4305 W. 24th Pl. Chicago, U.S.A.

SAVE Labor and Time

Eliminate heavy lifting. Cut handling costs. Table swivels and locks in any position. Can be varied 15½" by slight foot pressure, leaving operator's hands free. Engineered and built by tool engineers, experienced in production of special machines, dies, jigs and fixtures for exacting requirements.

Send TODAY for illustrated catalog No. 2.

MIDWEST TOOL & ENG. CO.
112 Webster St., Dayton, Ohio

DRILL CHUCKS

HARDENED STEEL JAWS

Write for catalog

WHY PAY MORE?

Capacity 0 to ½" fitted with No. 1 or No. 2 Morse taper shank.....$1.25 ea.

No. 1 or No. 2 Morse taper shanks with ½"x24 thread...73¢ ea.

Chucks without shanks....52¢ ea.

NIELSEN, INC.
LAWTON, MICHIGAN

placed the valve cover plates. The baffle plate is placed on top of the cover plate and the two are located and held in correct relative position by a stud with a bayonet fitting (for quick loading and unloading).

As the conveyor carries a loaded die under the rolls, a cam on the side of the die trips an air valve. This admits air into the pressure cylinders that bring the rolls into contact with the work. A limit switch automatically starts the timer. Immediately after the last spot is completed, the cam on the side of the moving die releases the pressure switch, cutting the timer and raising the rolls from the work.

The timer, itself, a Model No. 80 built by Weltronic Corp., 2832 E. Grand Blvd., Detroit, carries dial controls for setting 'current on' and 'current off' time—both adjustable in 1-cycle steps to from 1 to 30 cycles of current.

Although designed for a production speed of 450 pieces per hour, the machine is readily adjustable for any speed needed in relation to flow of parts in production.

Marvel Grinder Shield

With a frame or molded, high impact resisting, plastic material—with electrical parts in a completely insulated chamber (eliminating hazards from shorts) and mounted on a completely adjustable cadmium plated bracket, the Marvel Grinder Shield protects the eyes and face from flying particles. The light is focused right on the work. Better visibility is said to account for more rapid and accurate work. Push-button switch is conveniently placed. The window is of non-shatterable glass and lamps, of the bayonet type, vibration-resisting, are set-in flush with the frame. Magnifying lenses, of any focal length, are also available for close limit work. The lens is protected from pitting by a glass coverplate.

The streamline design harmonizes with modern machine tool equipment. Using the same magnifying lenses, this accessory is also ideally adapted to

close inspection work. In any shop, use of the same accessory for both purposes has many advantages because of the complete interchangeability of parts.

The Boyer - Campbell Co., Detroit, manufacturer, has been providing industry for more than 20 years with safety equipment.

Aluminum Ladder With Side Rails

A new type of aluminum ladder, especially suited for the storage of materials and maintenance work in industrial plants, is announced by Aluminum Ladder Co., 126 Adams St., Tarentum, Pa. The new ladder, designated as Type 800, is equipped with handrails on both sides, and steel or alumium spikes on the bottom. Aluminum spikes do not throw a spark and therefore are recommended for use around oil tanks and other places where inflammable materials are being handled.

The new ladder can be supplied in lengths up to 36 ft. long and in various widths. Rungs are corrugated to prevent slipping. Being made entirely of aluminum it cannot rust, rot, splinter or burn and is claimed to be twice as strong as ordinary ladders. Because of its light weight, it is readily portable.

GEARS **IN STOCK— IMMEDIATE DELIVERY**

Gears, speed reducers, sprockets, thrust bearings, flexible couplings, pulleys, etc. A complete line is carried in our Chicago stock. Can also quote on gears of any kind. Send us your blue prints aud inquiries.

Write for Catalog No. 70

CHICAGO GEAR WORKS, 440-48 N. OAKLEY BLVD., CHICAGO, ILLINOIS

END MILLS
Shear Cut
That's why PROGRESSIVE End Mills cut faster and easier and leave the smooth finish that you want.
Send for new catalog giving full information on the complete line and prices.
PROGRESSIVE TOOL & CUTTER CO.
2345 WOLCOTT ST. • FERNDALE, MICH.

Sanding and Polishing Machines

Portable Electric Disc and Oscillating Types.
Send for circular
THE NEDCO CO.
87 Rumford Ave., Waltham, Mass.

Hydraulically Operated Lubricators

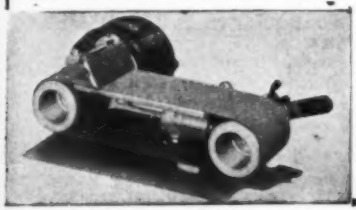
The increased use of hydraulically operated mechanisms to actuate machine elements, has resulted in similar operation of lubricator pumps. Heretofore, in various types of Bijur automatic lubricating equipment, the pump has been mechanically driven from one of the machine shafts or moving units. Bijur Lubricating Corp., Long Island City, N. Y. announce new types of automatic lubricators with no mechanical drive.

In place of driving mechanisms, a small diameter tube (5/32" O. D.) is connected between the machine hydraulic system and the pump used for feeding oil to the various bearings. This method has a distinct advantage in giving maximum flexibility in design and location.

The pumps illustrated are of two distinct forms: Type "C", for mounting on a standard oil reservoir; and Type "G," particularly adapted to mounting in an integral reservoir.

The lubricator pumps are arranged so that the inlet is submerged. This inlet is thoroughy protected by a large felt filter disc.

At the unit end opposite to the lubricator cylinder and in direct line with it, is located the hydraulic operating cylinder. The two pistons (lubricator and hydraulic) are connected by a common piston rod ball-jointed to each, insuring a free working assembly. A compression spring surrounding the piston rod, tends to force the latter towards the hydraulic cylinder.

AN INEXPENSIVE **ABRASIVE BAND GRINDER**

"Built Like A Machine Tool"
The Hormel-M Grinder is sturdily built with a supporting leg under the grinding table to eliminate vibration and tipping due to pressure on belt. Ball bearing throughout, equipped with Alemite lubrication, complete with grease gun.
Write for illustrated folder on this and other styles and sizes.
WALLS SALES CORP.
96 Warren St., New York, N. Y.

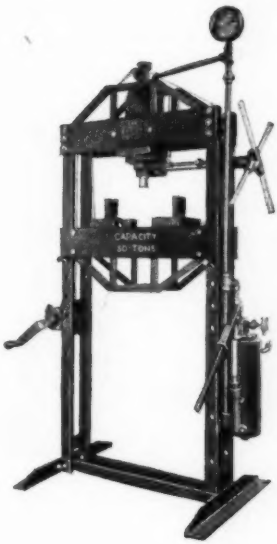
KRW HYDRAULIC ARBOR PRESSES

HAVE SPEED AND POWER FOR INDUSTRIAL USE

Rack teeth cut directly into ram—no separate rack bar.

Heavily constructed enclosed drum and ratchet raises and lowers bed.

Extensible cross-arms for greater leverage have locating grooves for extended and central positions.



Oil reservoir tank has convenient filling plug and shut-off valves.

V blocks furnished have machined shoulders for accurate alignment on bed.

Machined shoulders align V blocks when in inverted position and prevent slippage.

Built with the speed and strength necessary for industrial use, KRW Presses perform such operations as broaching, assembling, straightening, bending, offsetting, squeezing, pressing, and flattening. Small blanking operations can be performed when the blanking dies are built into a die set provided with guide pins.

Strictly a one-man press, special KRW features minimize operator fatigue. Trussed design of bed and crown members results in extreme rigidity and accuracy.

Write for new bulletin describing this cost-cutting equipment.

PRICES F. O. B. FACTORY, ARCADE, N. Y.

No. 37—35 ton Hydraulic and Sensitive Arbor Press	$150.00
No. 37E—50 ton Hydraulic and Sensitive Arbor Press	180.00
No. 37F—75 ton Hydraulic and Sensitive Arbor Press	300.00

Gauge and fittings, $20.00 extra on all presses.

K. R. WILSON

10-16 Lock Street, Buffalo, N. Y., U.S.A.

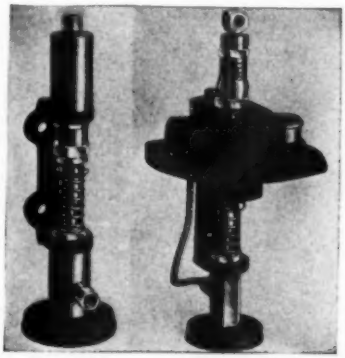
Export Department
90 West St., New York, N. Y.

West Coast Branch
722 Mateo St., Los Angeles

CARROLL
Universal Dividing Heads
22 Years of Popularity. 6", 10½", 12" Swing. Right or Left Hand Type.
Rigid. Accurate. Long-Life.
WM. CARROLL & SON
1776 Lexington Ave.. (Norwood) Cincinnati, Ohio

SCHAUER Speed Lathes
Timesavers for Your Plant
Speedy, economical tools for finishing, lapping and polishing small parts. Hand or foot operated collet, sizes from 1/64" to 1¼". Hand, foot or air operated 3-jaw chucks. 1, ½ or ¼ h. p. A. C. 2-speed motor.
Send today for circular 380
SCHAUER MACHINE CO.
2064 Reading Road, Cincinnati, O.

Thus, during the low pressure period of the hydraulic cycle, the complete piston and rod assembly moves under the action of the spring to one end of the stroke, drawing a definite amount of oil into the lubricator cylinder. Then, at the high pressure period, the assembly is forced to the other end of the stroke, discharging the oil to the bearing oil-distribution system.

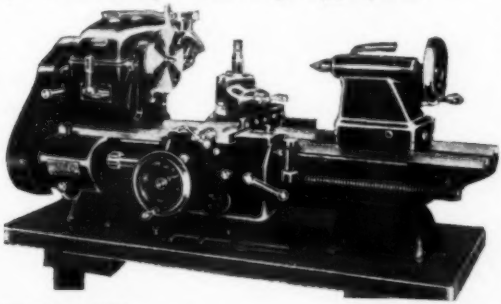


The hydraulic pistons are usually 5/16" diameter, oil pistons are 3/16" or 5/16" diameter, and the construction provides for ½" maximum stroke. A simple screw adjustment permits setting of the working stroke to any predetermined length desired to meet the lubrication needs of any particular model or type of machine equipped.

The "BABY GIANT"
VANDERBEEK Universal Joints
are obtainable in two sizes—the "Baby Giant" for instrument and control work; and the "Giant", with hardened and ground working surfaces for heavy duty work.
Send us your requirements — We'll send you prices.
AMERICAN TOOL WORKS, INC.
26 FRANCIS AVE. -:- HARTFORD, CONN.

A PRECISION, VERSATILE BENCH LATHE

Timken Bearing equipped. 12 inch swing over bed. 8 inch swing over slide rest. Modern hooded, V belt drive. Quick Change Gears. 4 to 224 threads per inch. Power cross feeds and longitudinal feeds are the SAME per revolution of spindle. Feeds are through worm and worm gear engaged by clutch.



Model No. 109 **Price $230.00**
Three other models in three bed lengths each.

See partial list of dealers at right.
Write us for name of dealer nearer to you.

Catalogue free.

CLAUSING MANUFACTURING CO.
433 Keota St., Ottumwa, Iowa

Representative Distributors.

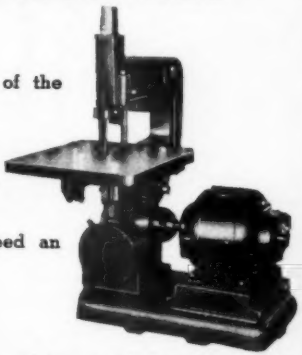
Atlanta, Ga., American Machinery Co.
Boston Mass., Chandler & Farquhar.
Brooklyn, N. Y., R. J. Atkinson.
Chicago, Ill., Samuel Harris.
Max A. R. Matthews.
Cleveland, Ohio, W. M. Pattison.
Columbus, Ohio, Osborne & Sexton.
Detroit, Mich., James W. George.
Kalamazoo, Mich., Henry Upjohn.
Kansas City, Mo.
Forslund Pump & Machine.
Louisville, Ky., Graft-Pelle.
Milwaukee, Wis.
Woodworking Mach. Sales
New York, N. Y., Bronx Hardware.
Philadelphia, Pa., Albert Hepworth.
San Antonio, Texas
Sam Speir Hardware.
San Francisco, Cal.
E. C. Doidge Machine.
Seattle, Wash.
Buckner-Weatherby.
St, Louis, Mo.
McDonald Machinery.
Toledo, Ohio
H. & H. Machinery & Supply
Vancouver, B. C.
B. C. Equipment Co.
Victoria, B. C.
Whitaker & Revercomb.

OLIVER OF ADRIAN
— DIE MAKING MACHINES —

FOR Less Expensive Dies —
Greater production per die —
Increased accuracy —
Savings, ranging from 50 to 60% of the labor over hand methods.

● ● ●

The Oliver method has been found superior over a period of 25 years. Why try substitutes.



Whatever your method, you still need an Oliver **to finish your dies.**

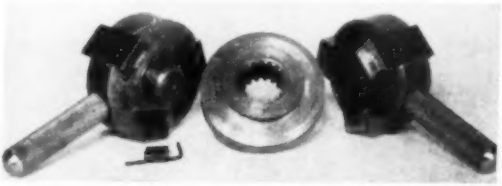
"Send for Literature"

Prices as low as $125.00

Oliver Instrument Co., 1408 E. Maumee St. Adrian, Mich.

Multiple Marking Device for Round Flats

A marking device designed to simplify marking, in production, of parts having annular flat faces, such as gears, bushings, bearing races, etc., has been introduced by New Method Steel Stamps, Inc., 143 Jos. Campau, Detroit.



The holder in which the type retainers are carried, is provided with a pilot guide to center the marking device. The type retainers are carried in the holder in T-slots. The type retainers themselves are provided with elongated slots on their inner faces. Into these slots fit balls under spring pressure located in the bottom of the T-slots in the holder. Thus the type retainers cannot drop out of the holder, but can be removed by a sharp pull, compressing the spring.

The type holders may be used for either solid type blocks or individual type, set screws being provided for locking the type in place. It is not necessary to remove retainers to change type.

A hardened and ground anvil is provided in the type retainers to prevent type from "sinking."

Cutting-off Machine

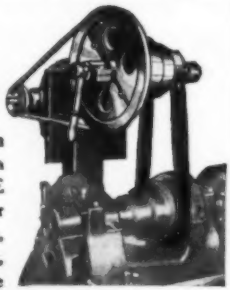
A new machine of the bonded-abrasive wheel type is announced by the American Instrument Co., 8010 Georgia Avenue, Silver Spring, Md. It is intended for cutting glass, quartz, ceramics, metals, commercial and semi-precious stones, etc., in the form of sheets, rods, tubes, and blocks.

Cuts up to 3½" can be made on materials with flat surfaces. Rods, tubing and the like up to 6" thick can be cut by rotating the material as it is being cut.

True, clean cuts are made speedily and precisely by means of a motor-driven 12" diameter rubber-bonded abrasive wheel (0.04" or 0.06" thick)—without chipping or breaking the material.

The machine is especially suitable for slicing all kinds of tubing and is said to make extremely short cuts. For

GUARANTEED FOR 5 YEARS



When you purchase a STEEGE Drive for your lathe, shaper, miller, etc., you're protected by our broad 5-year guarantee.

STEEGE Drives are easily installed—prices $35.00 up—sent on 30 days' approval. *Let us send catalog.*

W. L. STEEGE MACHINERY CO.
(Our 23rd Year)
548 W. Monroe St., Chicago, Ill.

Write for details

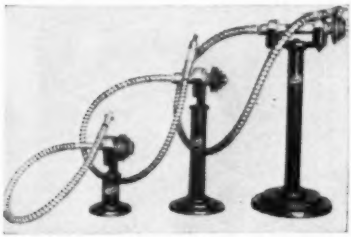
Cast YOUR Hammers with the FIELD MOULD and LADLE

Low cost, simple operation.

JOHNSON TOOL CO., Inc.
65 Massasoit Ave., EAST PROVIDENCE, R. I.

Three Speed Wyco Jack Shafts

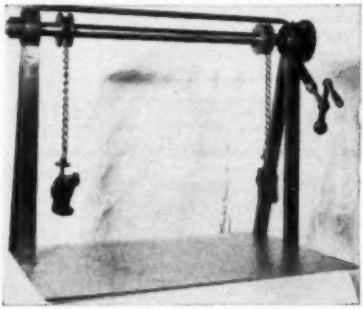
Bench and floor mounting units to drive flexible shafts from counter shafts or other power sources are offered by Wyzenbeek & Staff, Inc., 838 W. Hubbard St., Chicago, Ill.



The pedestals are of rigid construction with heavy cast iron bases, drilled for mounting. The general design is similar to the standard Wyco ball bearing multiple speed flexible shaft machines. Adjustment of belt tension is by rotating eccentric jack shaft housing. Standard heights of stands range from 9¾" to 28". Special heights will be supplied on order.

A Bench Type Die Separator

An overhead hoist for work bench use is offered by O. Johnson Mfg. Co., Brookfield, Ill. It eliminates the



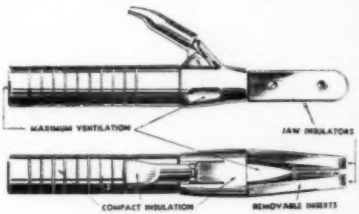
drudgery in handling dies that are ordinarily too heavy for one man to manage. It can also be used in connection with flat trucks.

Two sizes are available. The J-5 illustrated handles dies up to 36" long. Table is 28"x40"x3/16". Overall height is 33" and the swing between table and overhead shaft is 28". Can be made to any width up to 36"—or to any specifications required.

Style J-5 is for dies up to 26" long, with a 24"x30"x3/16" table, 31" in overall height with 26" swing. Shipping weights are 175 and 160 lbs. respectively.

Houston Super-Grip Electrode Holder

A new Houston Super-Grip electrode holder, in the 300 and 600 ampere sizes is offered by the Cullman Sales Co., 156 Temple Ave., Detroit, distributors of Cullman machine tool drives.



MODEL HSI-3

Among the interesting features stressed are parallel action jaws, increased rod-gripping ability and the handling of large or small diameter electrodes with equal facility.

The removable inserts can be taken out without disassembling. Removing two screws from each jaw, the inserts can be pried out with a screw driver.

The jaw insulators are of asbestos fiber composition which overcomes cracking—a fault sometimes encountered with moulded insulators.

Both jaws carry power from the cable receptacle to the electrode, and there is provision for complete ventilation. The jaws are said to have a Brinell hardness of approximately 170 and are made of "96" copper alloy.

A bulletin giving complete details will be sent on request.

GROUND
To Give Keenness

these Midget Cutters often give 7 to 10 times the increase in production per dollar of tool cost.

And what's more—Severance guarantees that they will give from 3 to 5 TIMES more production per tool — and keep on doing it every time they are re-ground.

So! Cut Your

Rotary Filing costs like one * Chief Executive who writes, "It will cut our tool costs at least three-quarters."

Write for Catalogue No. 12. Every Tool Man—Supervisor, Engineer or Designer—will want this little booklet, so pack full of time and money-saving ideas.

Profusely illustrated, it shows many unusual cutters and applications, lists Standard Midget Milling Cutters, "Chatterless" Countersinks, Tube Burring Cutters and Inside Burring Cutters as originated by

* Name on Request

Severance Tool Mfg. Co.
1510 E. Genesee Ave., Saginaw, Mich.

example, lengths of 1½" diameter glass tubing as short as 1/32 in. can be cut off as easily and quickly as longer lengths, and with smooth, parallel, unchipped edges.

The machine consists essentially of a non-corrosive cutting table (adjustable for cuts of various angles), a cutting wheel direct-connected to a 115-volt 60 cycle a-c. motor, a centrifugal pump (for pumping water from a built-in pump to the spray heads that play steady streams of water upon the cutting wheel), mounted on a rigid steel stand.

Complete details are given in the manufacturer's Bulletin No. HM 2074.

PYRO RADIATION PYROMETER

STOP spoilage. Get exact temperature of work in furnace. Direct reading; no calculations; no maintenance expense. Strictly automatic. Range 1000-3600° F.

Send for Illustrated bulletin No. 100.

THE PYROMETER INSTRUMENT CO.
102-105 Lafayette St., New York

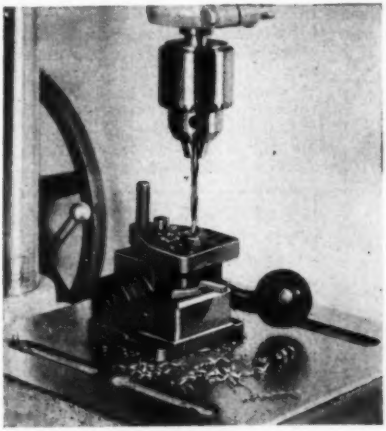
Cold Tinning Compound for Aluminum

A new tinning compound for aluminum is said to simplify the use of tin-lead solder to be sprayed on to aluminum and eliminating special aluminum solders and fluxes.

With this new tinning compound, it is claimed, the surface to be tinned is prepared in the usual way. A clean rag, moistened with water is then dipped into the compound and rubbed over the surface to be tinned until a shiny metal coating is formed. This coating then forms a permanent bond with the tin-lead solder which is sprayed on thereafter.

Further details may be obtained by writing direct to the manufacturer Glaser Lead Co., Inc., 29-31 Wyckoff Ave., Brooklyn, N. Y.

MIJIT DRILL JIGS



So Big In Savings
So Low In Cost

It's important to save money on small jobs—and the MIJIT Drill Jig offers you unprecedented opportunity for low cost precision machining of small parts in every line of industry.

Speedier loading and unloading means increased production — MIJIT Jig precision assures fewer rejects. The same jig can be used with different adapters.

Durable, simple and sturdy, MIJIT Drill Jigs are priced low enough to warrant the use of the number and assortment required for efficient economical production. There are four models for various types of work.

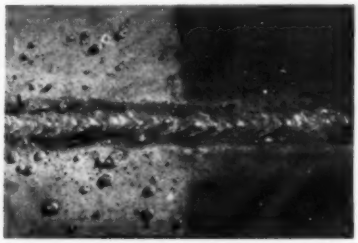
Consult us without cost or obligation if you have a difficult or expensive machining operation. *Or write for a new bulletin giving full information on Esco Drill Jigs.*

Esco Engineering & Sales, Inc.

4855 Fourth Ave., Detroit, Michigan

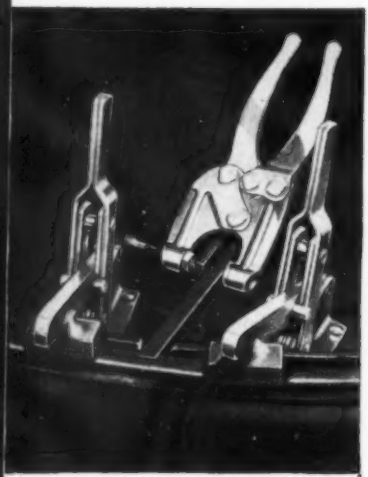
Reducing Weld Cleaning Time

"Spatter - Nox" is the descriptive name of a new compound which is claimed to reduce the spatter in metallic arc welding to an unusual extent.



If coated electrodes are used, it is said to cut slag cleaning time in half. It is asserted not to interfere with penetration, tensile strength or ductility, and to increase welding speed materially by permitting a more stable arc.

Full details may be obtained from Universal Power Corp., 4300 Euclid Ave., Cleveland, O.



Hold 'Em With DE-STA-CO Clamps and Pliers

To hold parts in production fixtures as for welding, drilling, reaming, machining or assembly operations use the quick-acting De-Sta-Co Clamps and Pliers. Complete line, all sizes. Send for Bulletin No. 40—illustrates clamps, gives dimensions, suggests uses.

DETROIT STAMPING CO.

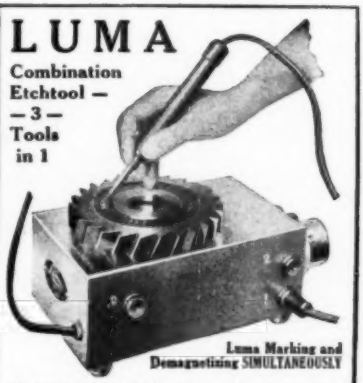
Established 25 Years

3443 West Fort Street,

Detroit, - - - Michigan

LUMA

Combination Etchtool — — 3 — Tools in 1



Luma Marking and Demagnetizing SIMULTANEOUSLY

Writes on hardened steel — demagnetizes at the same time—with carbon point does light spot annealing and soldering jobs. Compact—easy to use—dependable.

Send for details—5-day FREE TRIAL OFFER!

Luma Electric Equipment Co.

Dept. H—Main P. O. Box 132, Toledo, Ohio

ULTRA-CHEX
Precision Length Standards

NINE STANDARDS IN SET:
.0625" — .100" — .125" — .200" —
. 250" — .300" — .500" — 1" — 2"
with or without optical parallel.

Ask for bulletin No. 135, which discusses many applications for Ultra-Chex for daily use in your shop.

Price as illustrated $25.00, without optical flat $19.50.

GEORGE SCHERR COMPANY, INC.
122 LAFAYETTE STREET, NEW YORK

A Cutter's Biography

This interesting cutter fable follows the successive stages in the life of an 8"x1"x1¼" side mill.

In an entertaining way, the many shop experiences of this particular cutter are related, including the first rescue from the scrap pile and experimental recutting into a 7½"x⅞" side mill. Then came alternate periods of hard work and rejuvenation during which it is shown that this cutter saved at least $70 for the original purchasers.

It is a clever and attractive way of presenting one phase of the many reconditioning services offered by Master Tool Co., Cleveland, Ohio and the allied Companies, Eastern Cutter Salvage Corp., Newark, N. J., and the master Chrome Service, Inc., Cleveland.

A copy of the booklet will be mailed on request, and it presents a very convincing story.

Screw Machine Operators, who have equipped their machines with ALCO Tools, can —and do—keep their figures out of the red. Drill Chucks, Tap Holders, Die Holders—All have the exclusive floating feature which makes absolute concentricity not only possible, but sure. Positive and simple adjustment, quick and easy set-up. Minimum rejections on account of imperfect holes or defective threads. And don't forget that, since ALCO Drill Chucks and Tap Holders *require no bushings,* you can wipe out your heavy bushing inventory and cure your bushing headaches. Write today for detailed information.

Alco Tool Company, Bridgeport, Conn., U.S.A.

ALCO EFFICIENT TOOLS

BURR KEYSEATERS

Mill keyways in the run or on the ends of shafting already erected... save money on alteration, erection, and repair work.

Made in 4 sizes, for hand or motor operation.

Write for Bulletins and prices.

JOHN T. BURR & SON
429 Kent Ave., Brooklyn, N. Y.

MICROMETER OFFSET BORING HEADS

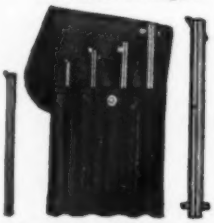
No. 35
$60.00

A New Flynn Micrometer Offset Boring Head

Write for catalogue.

Boring Bars

The new small bars 3/16, 1/4, 5/16 and 3/8 in. dia. Set of 4—$5. Larger bars up to 1½ in. diameter.



Flynn Manufacturing Company
435 Bates Street Detroit, Michigan

Eliminating the Dust and Fume Hazards

The new Berg Bankers Units offer an easy and economical method of maintaining the working atmosphere in a safe and clean condition. Constructed entirely of metal, the unit is sturdy, yet weighs no more than 55 lbs. There is no rubber hose. No heavy counterweights or thumbscrews are required for adjustment of the hood.

The units are particularly useful in welding applications and the hood may may be adjusted to cover every point in the average welding booth—a 12 foot circle. Hood is also adjustable vertically.

Bag filters are also available for various kinds of dust that cannot be handled with an ordinary cyclone collector.

Bulletin No. 5, giving full details will be mailed on request.

Dearborn Automatic Chucking and Indexing Fixture

This new fixture facilitates chucking and indexing in milling operations, permitting several operations on one piece with a single setting.

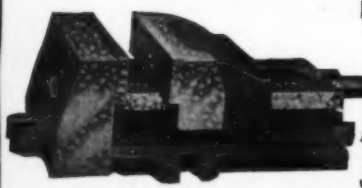
The work is held by draw in collets which will take up to and including one inch round. Hexagon and other special shapes can be handled with special collets. The collets are positively opened and closed and this overcomes sticking of the collet in the nose piece.

Through the use of collets, the work is held perfectly central, even if it is a little over or under size. Collets are opened and closed automatically

PLUNKET IMPROVED VISES

Made Right—Work Right—Give Satisfaction

Drill Press Vise

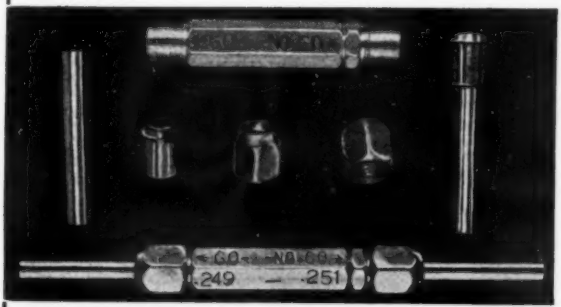


With Extra Lugs for Bolting Down
No. 1—4" jaws, 1¼" deep, opens 5". wt. 35 lbs. $23.40
No. 2—10" jaws, 2¼" deep, opens 8½", wt. 90 lbs. 34.20

Prices are net f. o. b. Chicago. Dealers' inquiries are solicited. Write for illustrated folder today.

J. E. Plunket Machine Co., 1823 W. LAKE ST., CHICAGO ILL.

Look! Get Double Your Money's Worth



Precision lapped to the brilliance of a diamond.

Tolerance for sizes .030" to .500" is 00005"

Tolerance for sizes .500" to 1.000" is 00008"

Gauging members can be turned on opposite ends when worn, giving plug 100% more life. Note the new aluminum handle and new brass collet construction.

All U. P. P. products guaranteed—25,000 gauges carried in stock—Shipment usually made the same day.

UNITED PRECISION PRODUCTS CO. 4618 W. HURON STREET CHICAGO, ILLINOIS

NEW ROCKFORD PRESSES

Built for exceptional **SERVICE**

Engineered for super performance and long life, you'll find in the New Rockford Presses, every modern advance—Chrome Nickel Crankshaft, Hard Bronze Bushings, Timken Bearing Back Shaft, to mention just a few.

There's a model for every requirement—and all are backed by more than 30-years' experience in press building. ***May we tell you more—and send a copy of our complete catalog?***

ROCKFORD IRON WORKS
ROCKFORD——ILLINOIS

SOCKET HEAD CAP SCREWS
SAFETY HOLLOW SET SCREWS

MADE OF ALLOY STEEL MILLED FROM BAR

Try Them On Your Next Job!
Or Write For Samples Today.

ECONOMY MACHINE PRODUCTS COMPANY
5207 Lawrence Ave., Chicago, Ill.

—GEARS—

Spur—Helical—Worm—Bevel—Miter, Etc.

We do broaching and all kinds of grinding.

We specialize in grinding hardened steel bushings, cam rollers, etc.

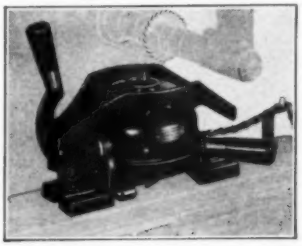
Prompt service and quality has retained a large list of customers for 25 years.

TAYLOR MACHINE CO.
1919 E. 61st St., Cleveland, Ohio

by the forward and backward motion of the milling machine table.

Performance claimed is 1000 cuts per hour in brass or free machining steel.

Collets may be instantly changed.



Indexing is done when the work is just back of the saw and before there is any tension on the operating chain.

1-2-3-4-6-8-12 or 24 sides or slots can be milled or holes drilled when used on a drill press.

A very complete description is given in a handsome new illustrated bulletin which will be mailed on request.

Nine New Types of Elastic Stop Nuts

Elastic Stop Nut Corp., 1015 Newark Ave., Elizabeth, N. J., announces expansion of its line through the introduction of nine new types of nuts, all of which embody the basic Elastic Stop self-locking element, a resilient non-metallic collar which is built into the head of the nut.

The new types are designated as thin hexagonal, spline, internal wrenching, countersunk and counterbored one-lug anchor, countersunk and counterbored two-lug anchor, countersunk corner anchor, bracket anchor, floating right-angle anchor, and floating basket anchor. With variations in sizes, thread systems and materials, 160 new standard items are offered.

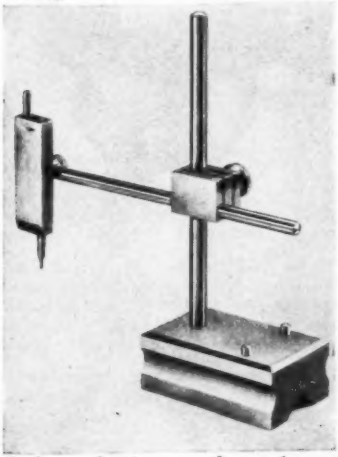
An illustrated catalog will be sent upon request .

Koch Universal Test Indicators

Several attractive features are emphasized by the manufacturer for these versatile indicators.

It is distinctive in that two live ends are provided, for inside and outside measurements to .001".

Combination balanced torsion and compression springs are used to sustain accuracy.



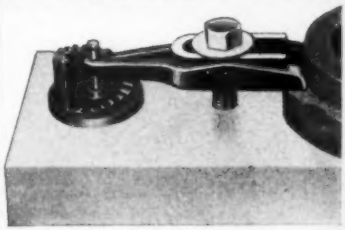
Each graduation on the scale represents 1/1000 of an inch movement of the plunger, or 2/1000 of an inch movement of the bell crank lever on opposite end of indicator.

In operation, the plunger moves away from, instead of against the lever, protecting delicate parts from sudden or excessive jolts of the plunger.

These indicators can now be obtained with a complete set of attachments, adapting it for inspection work on a surface plate, setting up work on milling machines or jig borers, or for testing flat surfaces where surface gauges are frequently used. Attachments fit any surface gauge with 5/16" binding post.

Complete information and prices may be obtained from Koch Test Indicator, Nyack, N. Y.

K-O ADJUSTABLE U CLAMPS



Rear of clamp quickly adjusted to height of work to be clamped by turning step elevation base. U clamp forgings scientifically designed to give maximum strength for their size and weight. Three point contact insures uniform pressure. Made in six sizes—three different styles. Cut shows our No. 4 with a ¾ bolt. This size sells for $1.25 with discounts for quantity.

SEND FOR CIRCULAR AND PRICES

K-O PRODUCTS CO.

Benton Harbor, Michigan

5000 SHAPES AND SIZES GROBET Swiss Files

Ask for Catalog WF.

The most complete catalog of its kind. Lists 5000 different shapes, sizes and cuts of GROBET Precision Swiss Files. Ask also for catalog WM on files for filing machines.

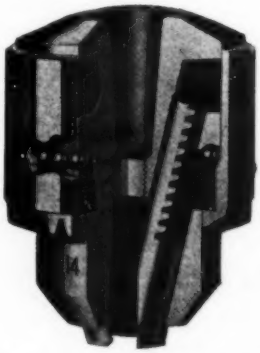
Learn more about these Chrome Steel Files that have won a reputation for utmost precision and durability.

GROBET FILE CORP. OF AMERICA 3 Park Pl., New York, N. Y.

Jacobs New Super Chuck

Increased strength and sturdiness for higher speed operation—improved gripping power — a new and better grip sleeve that is easier on the operator's hands—these are some of the attractive highlights presented by the new Jacobs ball bearing Super Chuck.

The body is hardened and ground throughout, including taper hole.



Ball bearings eliminate friction and provide for quick, smooth operation.

Jaws and nut are of a new Nickel Molybdenum alloy, selected for its strength and toughness. Jaws, nut and sleeve are subjected to an atmospherically-controlled heat treating process.

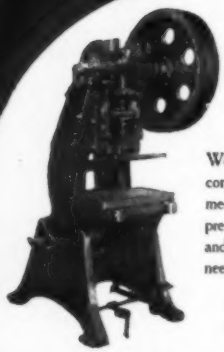
The sleeve is internally ground on three diameters for perfect balance.

Removal of screws converts chuck to hollow model.

Coarse pitch threads are used on jaws and nut.

A new bulletin gives full details on all of these innovations. Address The Jacobs Mfg. Co., Hartford, Conn.

RECLINABLE POWER PRESSES

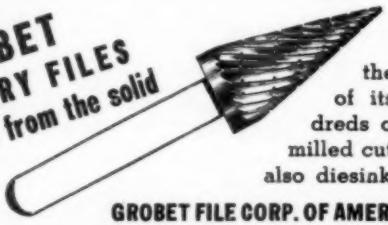


We manufacture a complete line of mechanical power presses, with sizes and types for every need in your shop.

Write for bulletins.

ZEH & HAHNEMANN CO.
Newark, New Jersey

GROBET ROTARY FILES ground from the solid



Ask for Catalog WG

the most complete catalog of its kind, illustrating hundreds of rotary files hand cut, milled cut, ground from the solid; also diesinkers' burs.

GROBET FILE CORP. OF AMERICA 3 Park Pl., New York, N.Y.

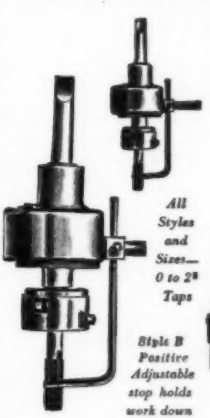
ERRINGTON MECHANICAL LABORATORY

MAIN OFFICE AND WORKS: STATEN ISLAND, NEW YORK

Chicago Office: 6422 N. RICHMOND STREET
New York Office: 200 BROADWAY
Boston Office: 830 OLD SOUTH BLDG.

CLUTCH OR CONE DRIVE

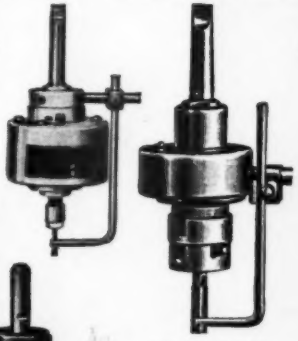
Our High Speed Tappers are Super-Sensitive for Small Tapping



All Styles and Sizes— 0 to 2⅜ Taps

Style B Positive Adjustable stop holds work down

Style D-E, Quick Change Tools



Style C Graduated Adjustable Safety Friction

MARSCHKE

HEAVY DUTY GRINDERS AND BUFFERS

Don't compare the price of the 1 H.P. MARSCHKE BENCH or PEDESTAL TYPE TOOL GRINDER with machines of similar capacity unless you compare details of design accounting for convenience and safety of operation. Compare, also, the material specifications and standards of workmanship. The Marschke is a quality product and quality is important because ***the best is always the cheapest in the end.***

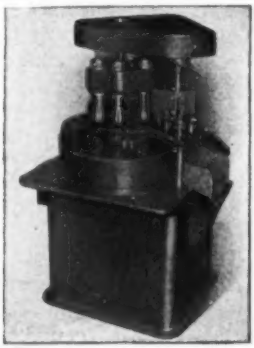
Let us send you the details of this small machine, together with a catalog showing **70 different Grinder and Buffer specifications** of MARSCHKE GRINDERS and BUFFERS.

VONNEGUT MOULDER CORP.

1805 Madison Avenue, Indianapolis, Indiana

Semi-Automatic Threading Unit

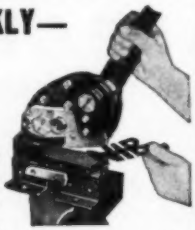
L. J. Kaufman Mfg. Co., Manitowoc, Wis., manufacturers of Hi-duty tapping machines, offer a new semi-automatic threading machine. It is claimed



to perform a threading and reaming operation on 1600 to 2100 steel pieces per hour. Loading by hand is done at the front, with parts ejected automatically at the side.

The machine embodies a 30 station revolving dial with suitable work holding inserts or chucks. It is equipped with three one inch rotating self-opening die heads and three reamers mounted in six individual spindles. Individual vertical adjustment is provided for each cutting tool. Three pieces are completed at every index movement of the dial. The various operating mechanisms are air controlled and interlocked. The large base has ample capacity for coolant, delivered by a motor driven pump at the rear. A three h. p. motor supplies power through "V" belts and the geared heads to the spindles.

DO IT QUICKLY— WITH A HANDNIB



Cuts sheet metal into any shape desired — in 1/10th of the time usually required — three-tools-in-one — a Nibbler, a Shear and a Drill Rod Cutter.

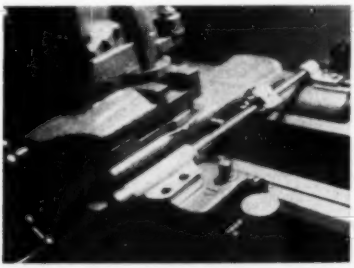
Indispensable for Toolroom and Experimental Work. Saves up to 90% on templates and trial blanks.

Send TODAY for descriptive folder.

NATIONAL MACHINE TOOL CO.
1536B Clark St., Racine, Wis.

Multiple Diameter Lathe Stop

A device for the accurate duplication of parts turned on an engine lathe has been developed by the Portman Machine Co., 2236 Bathgate Ave., New York City. This attachment can be fitted to the wings of the carriage



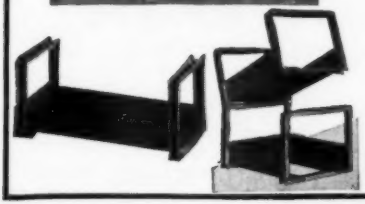
of any lathe, and consists of an indexing head, and four-way cross slide and rear bearing support. In operation, after a piece of work has been turned to the various diameters, the setscrews on the crosss slide are set in position and duplicate pieces can then be turned without continuous measuring of diameters. This device is made in several sizes to fit all lathes from bench models to large floor models.

THE LATEST TOTALLY ENCLOSED DUST-COLLECTING FINISHER

ARMGLO "SPEEDSTER" ABRASIVE BAND FINISHER

makes sanding . . . surfacing . . . polishing and burring of castings . . . dies . . . stampings . . . die castings . . . moulded products and machine parts an easy and quick operation. It eliminates slow, costly hand labor. In addition to fast production you get finished work that is flawless. Pays for itself many times over in time and labor saved. *Send TODAY for descriptive bulletin.*

ARMGLO COMPANY
3520 W. PIERCE ST. MILWAUKEE, WISCONSIN



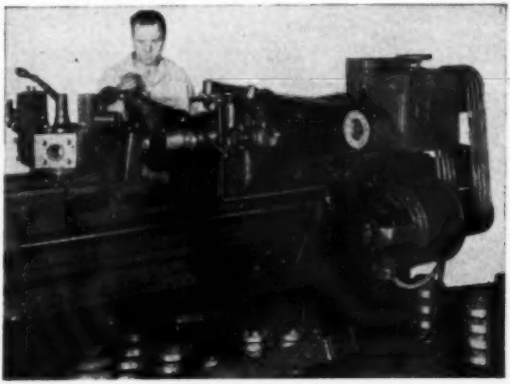
TAKE ANY BOX IN THE PILE . . .

the bottom one is just as accessible as the top . . . if you store your boxes in STACKRACKS. These sturdy, patented steel racks lock together to form rigid storage units of any size, shape or capacity . . . let you pile your boxes and still remove any one without disturbing any other.

STACKRACK storage cuts handling time . . . eliminates wasted effort . . . increases profitable work-hours. Write today for full information and low prices. Stackbin Corporation, 55 Troy St., Providence, R.I.

STACKRACKS
"STACKED AND STILL ACCESSIBLE"

Flexoid Motorizing Equipment



An answer to the problem of modernizing by motorizing machine tool equipment is to be found in the new Flexoid Four Speed Drive.

Compact and easily installed, it is rugged and efficient. The speed changes are easily made by turning a single hand wheel, providing standard ratios of 1:1, 1½:1, 2:1 and 3:1. This may be operated by remote control if desired.

Flexoid units are made in three models for capacities of from one to 10 h.p. The illustration shows application to a Warner & Swasey No. 6 turret lathe.

All gears are mounted on spline shafts, not on bronze bushings. Thus gears and shafts rotate together. Ball bearings are used throughout, and with the carefully worked out lubricating system, the units are said to be very smooth and quiet in operation. Shaft sealing prevents oil leakage and the units can be operated in various positions.

The unit is housed in a sturdy cast iron box. There are no protruding parts other than the parallel input and output alloy steel shafts and the handwheel control. The input and output shafts can be direct connected or flat belt, V-belt or chain drive used.

An attractive new bulletin may be obtained by addressing The Smith Power Tranmission Co., 410 Lakeside Ave., N. W., Cleveland, Ohio.

TANNEWITZ
Abrasive Cut-off Machine

Uses Abrasive Wheels or Saws, and instantly swivels and cuts any angle from 45° left to 45° right, doing clean, instantaneous work on metal bars, shapes or tubes.

THE TANNEWITZ WORKS
Grand Rapids, Mich.

GOOD NEWS!
for DIE MAKERS

Transfer Points Eliminate Guesswork in Die Making

There's no chance for error when you use transfer screws as markers in setting dies. Points are of uniform height above hex base. Six accurately made and hardened screws nest in a special holder with hex wrench tip. Made in ¼" to 1" diameters.

3/16"	$1.50 per set	5/16"	$1.25 per set	7/16"	$1.40 per set
1/4"	1.20 " "	3/8"	1.35 " "	1/2"	1.50 " "

HEIMANN MFG. CO., URBANA, OHIO

HOW MUCH **COMFORT** CAN YOU BUY?

ROOMS from $1.50
WITH BATH $1.75
also WEEKLY RATES

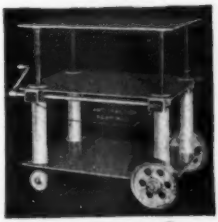
• A wonderful bed, a clean, quiet room, pleasant, efficient service; and a friendly atmosphere — these are what you get, and all you pay for, at the Madison-Lenox. No frills—just genuine comfort and consequently, genuine economy. An excellent location, with garage nearby.

VERNON W. McCOY, Gen. Mgr.

Detroit

HOTELS MADISON and LENOX MADISON AVENUE AT GRAND CIRCUS PARK

Hamilton Elevating Tables



enable one man to handle dies that would otherwise require two or three men to lift.

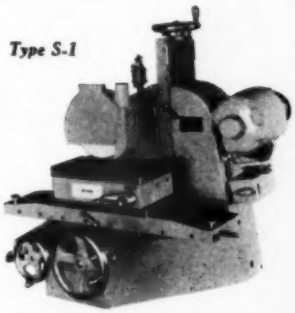
Send for illustrated circular.

The Hamilton Tool Co.
Hamilton, Ohio

The S-1 Surface Grinder —another BERGRAM Precision Grinder

1. Precision Spindle — Sturdy Construction.
2. Sensitive table travel.
3. Permanent magnetic chuck with grinding surface 5"x10"—no wires or generators. Electromagnetic chuck can also be furnished.
4. Interchangeable pulleys to compensate for wheel wear.
5. For groove grinding an adaptor is furnished for mounting small wheels.

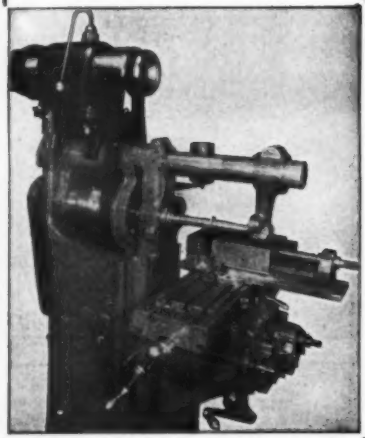
Type S-1



Bergram Mechanical Engineering Co., Inc.
"Specialists in Grinding Machinery"
23-27 WHITING ST. NEW BRITAIN, CONN.

New

LIMA GEARSHIFT MOTOR



FEATURES

Eliminates countershafts . . . 4 speed automotive transmission . . . All steel, heat-treated gears run in bath of oil . . . Hand wheel rotation of machine spindle . . . Instant reversability with all speeds . . . Designed for 1800, 1200 and 900 r.p.m. motors, either single or two speed . . . Adaptable for flat or "V" belt . . . Easily installed.

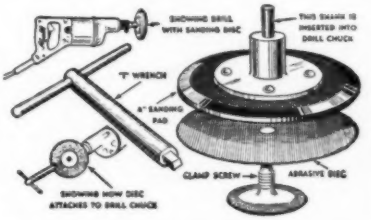
Write for complete information.

LIMA ARMATURE WORKS, INC.

440 N. MAIN ST. LIMA, OHIO

Mall Sanding Pads for Portable Drill Use

An improved sanding pad for use on any make, size or model of portable electric drill or flexible shaft machine is announced by the Mall Tool Co, 7742 So. Chicago Ave., Chicago, Ill.


SHOWING DRILL WITH SANDING DISC
THIS SHANK IS INSERTED INTO DRILL CHUCK
"T" WRENCH
4" SANDING PAD
CLAMP SCREW
ABRASIVE DISC
SHOWING HOW DISC ATTACHES TO DRILL CHUCK

It is intended primarily for doing occasional sanding jobs where the amount of work does not warrant a standard sanding machine.

The standard pads have ¾" holes, and are mounted on the hand spindle mandrel so they will turn freely. The abrasive disc is placed on the face of the pad and held in place by the clamp screw. The shank on the sanding pad is inserted into the drill chuck and tightened in the same manner as a drill bit.

The equipment comprises a four inch sanding pad, one abrasive, a clamp screw to hold the abrasive and pad in place and a T-wrench to remove or fasten the pad and abrasive.

Full information is given in a new four-page bulletin.

H. O. BATES

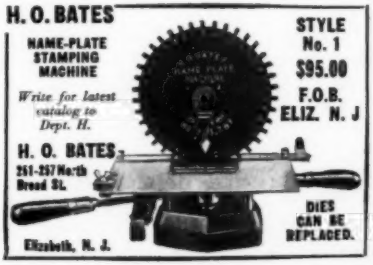
NAME-PLATE STAMPING MACHINE

Write for latest catalog to Dept. H.

STYLE No. 1

$95.00

F.O.B. ELIZ. N. J



H. O. BATES

251-257 North Broad St.

Elizabeth, N. J.

DIES CAN BE REPLACED.

Blank & Buxton Develop New Model

A new No. 40 Index combination mill and locator is announced by Blank & Buxton Machinery Co., Jackson, Mich. It is the same machine basically as the No. 39 with verniers, cross and longitudinal and speed reduction arrangement added in order to get lower speeds for boring. Included in this speed reduction is a variable speed pulley on the motor which is adjusted by moving a lever projecting from side of housing while motor is running. This in conjunction with the six step pulley or spindle, belted to six step pulley on intermediate shaft makes practically available an infinite speed range from 100 to 2820 r.p.m.

For the small shop which heretofore has been unable to afford a high priced locating machine, the Index No. 40 makes available at a reasonable price, a machine that will work up a die or fixture 8" x 16" at one setting to vernier accuracy. To the shop which already has one or more high priced locating machines, the Index offers relief by taking the smaller work which usually has to wait, although it may be just as important as the larger parts.

Operations of milling, drilling and boring at various angles can be done at one setting and offer real savings.

The makers say the machine is designed to do end mill work from 3/32" to ¾" in tool steel and will bore holes up to 3" very easily On test, a hole 5" diameter was bored in cast iron, but this would be impractical except in emergencies.

The head swivels and is graduated 90° right to left, controlled by worm and worm gear. Spindle has No. 9 B. & S. taper, is mounted in preloaded super precision ball bearings and has 3¼" travel, controlled through screw and nut.

Working surface of table is 8" x 22",

overall length, 32". Travel of table cross, 8", longitudinal 16", vertical 15". Distance from center of spindle to column, 8-¼". All screws have micrometer dials in addition to cross and longitudinal verniers. Weight is approximately 1000 lbs. Machine comes equipped with draw bar, 4½" swivel base vise (which opens 3¼") heavy duty, single phase repulsion induction motor, and built-in starting switch with overload protection.

REMOVAL NOTICE!

THE PRECISION TOOL COMPANY

ANNOUNCES THE REMOVAL OF ITS EXECUTIVE OFFICES FROM BRIDGEPORT, CONN.

To BROOKLYN, NEW YORK

All Correspondence, Inquiries and Orders should be sent to

THE PRECISION TOOL COMPANY

P. O. BOX 155, BROOKLYN, NEW YORK

Telephone: MAin 4—1064 *Cable Address: Pretool-NewYork*

Knu-Vise Develops "KV" Clamps

The "KV" series of Knu-Vise toggle clamps offers several innovations, the most important being that the toggle bar is made in two halves, spot-welded in position at assembly. The compression link pivots on the inside of this toggle bar, which in turn rotates on the outside of the steel base casting. It is emphasized that this is definitely an advantage, the casting providing greater wearing surface.

All components are hardened, and cadmium plated, except for the base which is black enamelled. There are four clamps in the series, all of which have fixed bases of Tee section with an ample clamping flange. Prices are said to be materially lower than on previous types.

The type shown is model No. 110. Full details may be had by addressing Knu-Vise Inc., 2895 W. Grand Blvd., Detroit, Mich.

Start 1940 Right

by using

WALTON TAP EXTRACTORS

They remove taps broken at or below the surface of the hole easily, quickly and without injury to the threads.

Send for Folder 132 giving sizes, styles and prices.

Test their worth by 30-day Free Trial.

The Walton Co.
95 ALLYN STREET
HARTFORD, CONN.

SHELDON
Back Geared Screw Cutting PRECISION LATHES

A complete line of full sized, full weight 10", 11" and 12" Precision Lathes . . . bench, floor and pedestal types built to industrial machine tool standards and specifications. Rigid heavily braced, semi-steel beds with hand scraped ways —2 "V"—ways and 2 Flat Ways. Large hardened steel spindles, ground all over and individually fitted into hand scraped bearings. Each lathe has a full compliment of attachments and accessories. Each model gives more lathe per dollar.

See the SHELDON before you buy.

SHELDON MACHINE CO.
1629 N. Kilbourn Ave., Chicago, U.S.A.

Mechanics Through the Ages

ODDLY ENOUGH, IN THE WINTER OF 1777, WASHINGTON'S ARMY SUFFERED AND FROZE ON THE EXACT SPOT WHERE THE FORGES OF PENNSYLVANIA'S COLONIAL IRON FOUNDERS HAD EARLIER BELCHED FORTH THEIR HEAT. THE NAME "VALLEY FORGE" WAS DERIVED FROM THESE PIONEER FORGES...

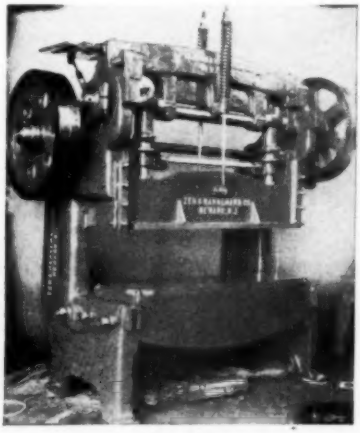
USING ONLY A HANDFUL OF CHARCOAL, A MINIATURE 8"X4" SHEET IRON FURNACE WITH HORIZONTAL BELLOWS, EIGHT TINY CUPOLAS THE SIZE OF PIPE-BOWLS, AND BITS OF CAST IRON FOR SOLDER, CHINESE TINKERS OF THE 1700'S ACTUALLY MENDED CAST IRON FRYING PANS THAT WERE CRACKED AND FULL OF HOLES! THE CRAFTSMAN CARRIED HIS ENTIRE APPARATUS IN A BOX 16" LONG BY 6" WIDE AND 18" DEEP!

ALTHOUGH COMMONLY REGARDED AS A GREAT ENGINEER WHEN HE BUILT HIS STEAMBOAT "CLERMONT" IN 1807, ROBERT FULTON IS SAID TO HAVE BEEN SO IGNORANT OF MECHANICAL MATTERS THAT HE WAS THE LAUGHING STOCK OF HIS SHOP EMPLOYEES!

Zeh and Hahnemann Presses

A wide range of types and sizes of presses is offered by Zeh & Hahnemann Co., 182 Vanderpool St., Newark, N. J.

One of the latest models is designed as the Type 13, and it has been built in 25 and 36 ton sizes. These units are of the double crank overhanging type, arranged so various right to left dimensions can be furnished on request. Slides on the larger presses are spring balanced. The unit shown is back geared but the plain type can also be furnished. Larger capacities can be supplied in this type if desired.



Other items in this highly diversified line include:—patent percussion power presses; reclinable and open back gap presses; double action and double crank presses; punching, horning, toggle, arch, reducing, drawing and screw presses; notching machines; roll, dial and grip feeds; bottom knockouts; cut and carry attachments; automatic finger gauges; material reels; straightening rolls; scrap cutters and winders, etc.

Bulletins covering any or all of these will be sent on request.

MODERNIZE present equipment with a RUSSELL BORING BAR. Bores 9/16" to 12" dia. with boring axis parallel to shank axis. One compact tool, with micrometer adjustment.

RUSSELL BORING BAR CO.
MIDDLETOWN, OHIO

Special Anti-Mushrooming Anti-Chipping Heat-treat
Oversize Shanks
Exclusive Knurled Back
Exclusive Thumb Grip
Broach-Rounded Corners

and a complete line of Marking Devices

Write for Price and data Bulletin No. 113-12A

NEW METHOD STEEL STAMPS, Inc.
149 Joseph Campau, Detroit

For Machine and Tool Work & Quick Set-Ups

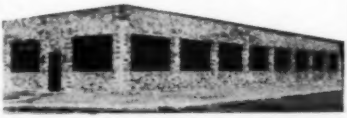
The only 3-way reading precision indicator. Accurate in either direction. Feeler mounted in centered cone bearings. .014 reading. New improvements.

Price $5.00 *Write for folder.*

J. R. Reich Manufacturing Co.
334 Triangle Ave., Dayton, Ohio

Buyers' Service Directory

LET US QUOTE . . .



Our new modern plant is fully equipped with special machinery for

COMMERCIAL JIG BORING, DESIGNING AND BUILDING

of

DIES, JIGS AND FIXTURES LARGE OR SMALL

We can handle your Jig Boring jobs at reasonable prices on our new 18"x36" Pratt & Whitney Jig Borer. Quick service.

Have been delivering satisfaction since 1929—let us serve you.

QUALITY TOOL & DIE CO.

Ray W. Rice, Manager,

401 N. Noble St., Indianapolis, Ind.

GRIND THE EASTERN CENTERLESS WAY

ACCURACY-FINE FINISHES-LOW COST

Large or Small Lots

EASTERN CENTERLESS GRINDING CO.

624 Capitol Ave., Hartford, Conn.

CENTERLESS GRINDING

Straight—Tapered—Double Diameter
Shoulder and Profile Diameter
Internal Grinding—External Grinding
Taper and Straight Dowel Pins Made to Order
Screw Machine Products Heat-Treated
Before Grinding If Necessary

Industrial Centerless Grinding Co.

14644 Schaefer Road Detroit, Mich.

Centerless Grinding

(CONTRACT WORK)

PRECISION, FINE FINISH, LOW COST

May we quote on your specifications.

THE HEIM COMPANY

Fairfield, Connecticut

World's Lowest Cost

STAMPINGS

in small or large lots

Special: Total die and stamping cost for 1000 flat blanks most any shape up to 10 sq. in. ..... **$25.00.**

We can save you money on all types of sheet metal parts in small quantities.

All types of dies designed and built.

SOUTHERN PRODUCTS

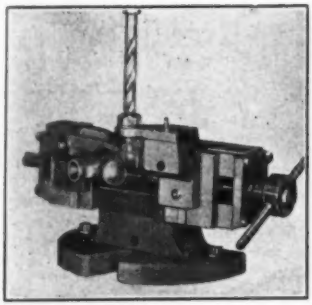
Dept. H10 INDEPENDENCE, MISSOURI

The latest Development is simplified threading.

SAVES time, costs and trouble . . . . INSURES production. Write for NEW BULLETINS showing how to solve threading problems.

Eastern Machine Screw Corp.
27-27 Barclay St., New Haven, Conn.

"JOHN'S" DRILL JIGS



Modern Production Tools for all Drill Press Operations.

HEUSER MFG. CO.
1638 N. Paulina St., Chicago

M-B Utility Pneumatic Grinder

A new model U-TR streamlined grinder is offered by M-B Products, 130 E. Larned St., Detroit, Mich. It features a steel housing (for safety) and high speeds up to 60,000 r.p.m

It is a sturdy tool intended for real production and tough jobs.

The spindle is of extra heavy construction, using a special alloy steel. It is heat treated and ground to close limits.

The makers assert that the problem of lubrication has been entirely eliminated through the use of special grease-sealed bearings. No manual or automatic lubricating is required.

The spindle accommodates mounted grinding wheels, cutters, rotary files, etc, with ¼" diameter shanks.

Three stages of impulsion are said to provide an abundance of power. Air cooled in operation, there is no heating.

The unit weighs 2¼ lbs., overall length is 9" and length of body is 5⅝". Accessories include a 7 ft. hose line, fitted with dirt filter, two drop forged wrenches, four mounted grinding wheels, all packaged with unit in a solid oak case.

ILLINOIS GEARS

Gears for Every Purpose

The most approved type of equipment and skilled craftsmen of our large modern works ensures you of a complete gear service of highest quality. You can always depend upon prompt de iveries.

ILLINOIS GEAR and MACHINE CO.
2114 N. NATCHEZ AVE. CHICAGO

The "MAIL BAG"

A monthly clearing house for readers' problems and requirements. Inquiries and recommendations will be forwarded to the readers. Answers that are of general interest will be published.

—1—

A lapping machine is required to lap holes ranging in diameter from 1/16" to ¼" and about 1⅜" long on work similar to wire dies. Material is hardended and ground tool steel. Holes are "through" and ends of pieces are ground after lapping to insure elimination of belled holes. If possible machine should be semi-automatic.

—2—

Information is requested on a tool room die grinder, to be used in connection with maintenance of punch press dies, which have to be ground inside and outside of a number of rings. The smallest inside circle is 4½" and the outside of the largest die is 30". Travel of grinding wheel need not be more than 10" or 12". Would like to handle all of this work on one machine if possible, but would purchase two machines if necessary.

—3—

An electric cyanide pot and an easy method of copper plating steel washers 11/16" x 3/16" are the subjects on which information is desired by a Western reader. Copper plating is to control hardening. (Evidently he is thinking of copper sulphate dip plating. Both washers are to be swedged while soft, after which one washer is to be case hardened and the other is to remain soft.)

—4—

Quantity production of ⅜" shafts carrying both right and left hand threads is desired. Threads used on a model are five per inch but can be increased to seven or possibly eight if this would simplify production. The thread required would be similar to that used on automatic (push) screwdrivers. This reader is willing to have a die made, or will contract for die casting if he can find someone to do either job for him.

—5—

A 50-lb. belt driven trip hammer is required for hammering soft copper tank heads. It will have to be placed on existing I-beam frame which "has a throat of six feet." Prices with cuts or sketches are requested.

—6—

Information is requested on a rod heading machine to head No. 6 and 7/32" diameter, galvanized hard .12 carbon content wire in lengths of 12" to 19".

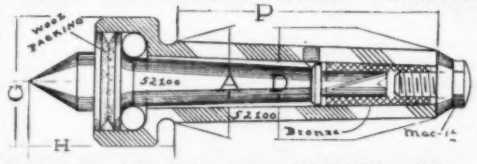
—7—

Special track presses for rebushing tracks of Caterpillar and other tractors form the subject of another inquiry. What is wanted is an hydraulic machine that will press out old pins, space blocks and press in new pins on both tracks.

—8—

A manufacturer in Portugal wishes information as to machines for manufacturing paper condensers and transformers for radio sets.

RIGID RESILIENT BULL CENTER



Rigid Tool Holder Co., 2,000 Witherell St., Detroit, Michigan

A disappointed buyer is slow in paying for his disappointment; while we have never yet, lost a dollar, on a purchase order; or a customer that we know of; and seldom send out a "Please remit". But we are real cranky, about good work, and good material. The best is none too good. Excellence in Designing and Manufacturing is Excellence in Advertising.

All Morse tapers carried in stock.

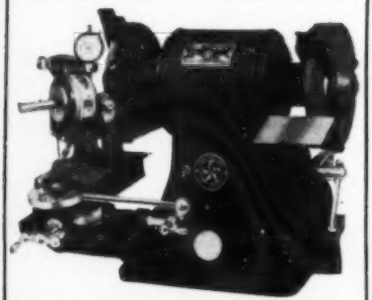
LITTELL **Air-Blast Valve for Faster Safer Production**

PAYS its cost in a few weeks time in —increased production—greater safety — economy of air. Automatically ejects pieces. Operator's hands are never in danger zone. Quickly adjustable air nozzle.

Automatic Roll Feeds—
dial feeds, magazine feeds, hopper feeds, for punch presses. Reels for coiled stock. *Send for Circulars.*

F. J. Littell Machine Co.
4153 RAVENSWOOD AVE., CHICAGO, ILL.

Precision Drill Grinder



Simple to operate—dependable—speedy—this Precision Grinder will enable you to produce perfect joints on standard twist drills in sizes from No. 41 (.096) to 5/8" (.625).

Send today for more details.

Star Machine & Engineering Corp.
Division Star Electric Motor Co.
Bloomfield, - - - New Jersey

Polishing Stainless Steel Sheets

A new unit designated as No. 27-H, has been developed for the stainless steel industry by Excelsior Tool & Machine Co., East St. Louis, Ill. It uses standard commercial paper 16-ft endless abrasive grinding belts, obtainable from abrasive belt makers in any width and grit. Grinding belt speed is 3500 surface feet per minute.

Carriage travel is 58 lineal feet per minute, adjustable for any length sheet, operated direct from a reduction geared motor. The sheet is passed back and forth the required number of times under the grinding belt. Grinding head is then raised, carriage stopped at extreme forward travel, clamps released and finished sheet removed.

The clamping fixtures are positive and carriage cannot overtravel, preventing damage to grinding belts, or rubber covered pressure drum, on which any required pressure is applied by removable hand weights, for positive regulated pressure over entire width and length of sheet to be polished. Over-size dust proof ball bearings are used throughout

Power requirements are 30 h.p., to operate grinding belt—2 h.p. to operate reversible carriage. Floor space occupied is 5 x 30 ft. Machine is 7 ft. high, and weighs 13,500 lbs. Standard sheet polishing capacity any width, length and gauge up to 48" wide, 144" long, No. 4 to 7 finish.

Accurate Hole Transfer Made Easy With NIELSEN TRANSFER SCREWS

Simply insert in holes, invert, strike sharply and you have centers and drill circles perfectly located. Reduce time and eliminate spoilage of other methods. 7 sizes U.S.S.— Inexpensive— last for years.

Write for Circular
NIELSEN TOOL & DIE COMPANY
1839 Gardner Ave.
Berkley, Mich.

New Trade Literature

CUTTERS AND ACCESSORIES

The George Gorton Machine Co., Racine, Wis., announce a new accessories catalog and the establishment of an Accessories Dept., to handle the increasing volume of small tool and accessories sales.

This new catalog represents an innovation so far as the Company is concerned, as it shows the prices on all items listed, including cutter grinders and graduating machines. A copy is available to anyone writing on a business letterhead.

TUNGSTEN CARBIDE TOOLS AND TIPS

Willey's Carbide Tool Co., 1344 W. Vernor Hwy., Detroit, announces a new catalog No. 24, that shows latest prices on Tungsten Carbide tools and tips, together with a number of useful tables applying to the application of Carbide tools.

They also announce release of a number of new grades of Carbide metal that will cover the full range of machining various materials for which Tungsten Carbide is adapted, together with speeds and feeds that are practicable to use for each grade.

BUILDING MAINTENANCE HANDBOOK

Flexrock Co., 2305 Manning St., Philadelphia announce a new edition of their building maintenance hand book. Some of the good features of the previous book are retained but for the most part it is a new edition completely revised.

The new edition devotes 64-pages to a very comprehensive discussion of building maintenance problems from the ground up, starting in with various types of floors and how to fix them.

Calking, leaks, ceilings, roofs and many other topics are covered, with many illustrations. A copy will be sent if you write on your letterhead.

PORTABLE GRINDERS

Wodack portable electric grinders for many purposes are presented in a new bulletin No. 393 issued by Wodack Electric Tool Corp., 4629 W. Huron St., Chicago, Ill. The line includes tool post, angle plate, internal-external and high speed grinders, in addition to several styles of hand grinders, sanders and buffers.

TOGGLE ACTION CLAMPING TOOLS

Catalog No. 4 issued by Knu-Vise Inc., 2895 W. Grand Blvd., Detroit presents 16 pages covering the full line. Many of the different types of clamps are shown in half tone illustrations with detail drawings in blueprint style. There are many job illustrations showing the clamps in actual use.

PRECISION TOOL ROOM LATHES

A beautiful new broadside No. TRL-739 introduces impressively, the LeBlond precision tool lathes. Printed on linen stock, a 13"x 21" illustration of the 12" lathe reveals every detail plainly. Cutaway views show interior parts and other important components. Text and specifications leave little to the imagination. For a copy, address L. K. LeBlond Machine Tool Co., Cincinnati, O.

SAFETY GUIDE POST COVERS

A new eight page 3-color broadside with a very graphic front cover introduces the Danly safety guide post covers. These easily applied safeguards protect the operators and prevent accidents which might wreck the work, dies and the press. The different sizes and types are illustrated and described and prices are given.

Address Danly Machine Specialties, Inc., 2112 So. 52d Ave., Chicago, Ill.

BAND FILING MACHINES

A new descriptive folder on Continental Band Filing machine is announced by Continental Machines, Inc., 1300 S. Washington Ave., Minneapolis, Minn.

Specifications and illustrations of the FM and FC models are given, both of which work by the continuous filing method.

Three different widths of file bands are used, viz., ¼, ⅜" and ½. A number of typical jobs are shown.

CHROME PLATED GAGE BLOCKS ..

A new leaflet describes a recent Johansson gage block innovation—chromium plating for sustaining accuracy over longer periods of useful service. Worn sets of old Johansson blocks can be returned to the factory for restoration to their original accuracy by chromium plating, or they may be exchanged for the new chromium sets at prices quoted. Address Ford Motor Co., Johansson Div., Dearborn, Mich.

ANGLE TANGENT TO RADIUS DRESSERS

An attractive new bulletin of the Vinco Tool Co., 7350 Central Ave., Detroit, Mich., illustrates and describes their clever method of dressing radii and angles tangent to radii. Construction of the tool is revealed in large views, and a number of typical applications are shown.

FLEXIBLE SHAFT EQUIPMENT

A new 28-page catalog "MST" is announced by the C. L. Jarvis Co., Middletown, Conn. The many different types of Jarvis flexible shaft machines are introduced and described. Of special interest is the detailed description of the Jarvis-Biax shaft construction, which makes it possible to cut off any required length without any unraveling. The line of attachments, grinding wheels and rotary files is included.

BUILD YOUR OWN WELDER

A new six page bulletin No. 427, issued by The Lincoln Electric Co., Cleveland, O.,

gives the essential equipment for building your own engine-driven welder, with illustrations of a number of "home-made" outfits. Generators, mounting bases, couplings, governors, idling devices, etc., are covered. Welding accessories and the different electrodes available are included.

CARBIDE TOOL DATA

The fundamentals of cutting steel with carbide tools are contained in Engineering Bulletin GT-120 published by Carboloy Co., 11139 E. 8-mile Rd., Detroit.

An extremely practical feature is a set of charts giving specific carbide grades to use, recommended starting speeds, general range of practical speeds, and recommended tool rakes and clearances for a wide range of steels. The charts also provide a means for determining the power required for each material.

COLLET CHUCKS

A four page folder giving details and dimensions of their new "precision" collet chuck for close accuracy on drilling and end-milling work is available on request from Erickson Steel Co., East 80th St. and Bessemer Ave., Cleveland, Ohio.

PRESSES AND SHEARS

The complete line of Niagara Open Back Inclinable Presses is presented in bulletin 58-H. Bulletin 80-C illustrates and describes the latest Niagara foot operated squaring shears and hand operated circle shears. Address Niagara Machine & Tool Works for copies, at 637 Northland Ave., Buffalo, N. Y.

AUTOMATIC AND TURRET LATHES

A new 16-page catalog with many large illustrations, leaves little unsaid about the 8" Fay automatic lathes. All of the interesting mechanical features are illustrated and described.

Three additional catalogs cover the ram type Nos. 3, 4 and 5 universal turret lathes in red and black on ivory tinted pages—saddle type universal turret lathes Nos. 7A, 7B and 7D in blue, black and ivory—and the saddle type universal turret lathes 8A, 8B and 8D in black and green with little green panels.

All three of these catalogs are of 24-pages, with gloss covers and spiral binding and they leave a very favorable impression of the machine tools described. Copies may be had by addressing Jones & Lamson Machine Co., Springfield, Vermont.

WIRE ROPE CLAMPS

"Safe-Line" Wire Rope Clamps are described in a handsome new three-color broadside issued by the National Production Co., 4561 St. Jean Ave., Detroit, Mich. The clamps comprise four parts — two taper threaded sections, split longitudinally are placed on the exposed sides of the wire rope. These are squeezed together in a vise-like grip when the two tapered nuts are tightened on the ends of the threaded sections.

VENTILATING EQUIPMENT

A new ventilating unit designed to remove corrosive, toxic, high temperature and hazardous fumes is fully described in the new illustrated 12 page Bifurcator Catalog just issued by the DeBothezat Ventilating Equipment Div. of American Machine and Metals, Inc., East Moline, Ill. The DeBothezat Bifurcator, which takes its name from the word "bifurcate," meaning "to separate," consists of an axial-flow pressure fan mounted in a patented housing with the motor set in a separate built-in chamber, entirely isolated from the air flow. DeBothezat Bifurcators are available in sizes from 8" to 48".

CARBIDE TOOL SALVAGE

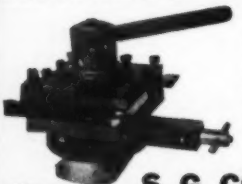
Picking hidden dollars out of the carbide tipped tool scrap pile is the theme of a new bulletin issued by Super Tool Co., 21650 Hoover Rd., Detroit, Mich. All details of Super's new carbide tool salvage division are explained, with illustrated typical examples of the savings possible.

RIGIDMILS, AUTOMATIC LATHES AND AIRPORT EQUIPMENT

Two bright new bulletins from Sundstrand Machine Tool Co., 2535 11th St., Rockford, Ill., cover the No. 0 and 1 Rigidmils and the 8, 10 and 12 automatic lathes.

Another new Sundstrand bulletin presents balancing tools, bench centers and airport service equipment. The new airport balancing tools swing work up to 11 feet in diameter and are useful for balancing propellers and other parts. Equipment for checking propeller pitch comprises a rigid bed with accurately scraped top, mandrel support at one end and accurate protractor.

Increase Production And Profits



11" Lathe Size

by using Colwell Tool Post Turrets to save time and labor on repeat operations. Available for 9" to 20" lathes with a new "Midget" size for smaller lathes. Also furnished for turret lathes. Provides four positions. In operation it is fast, simple, accurate and dependable.

Write TODAY for your copy of bulletin.

S. G. COLWELL 25 Congress Ave., Providence, R. I.

GEARS

Catalog No. 39 of the Illinois Gear & Machine Co., 2114 N. Natchez Ave., Chicago is resplendent with a brilliant orange and black laminated cover and spiral binding. Sixty-four pages are devoted to a detailed presentation of the vast number of gears made at this plant. Useful engineering data and formula are given for many different kinds of gears, with tables and specifications of dimensions.

TURRET LATHE TIPS

"Blue Chips" is the title of an interesting new four page house organ published by Warner & Swasey Co., Cleveland, Ohio. With business mounting, turret lathe operators are faced with an increasing flow of work. Many younger men are operating lathes and they have had less experience than the old hands. Often a slight change in the tooling or technique of handling a particular job will increase production greatly. "Blue Chips" presents many hints and suggestions for handling unusual jobs. It will be mailed free of charge to any turret lathe operator who requests it.

TOOLMAKERS' MICROSCOPES

A bulletin recently issued by The Gaertner Scientific Corp., 1201 Wrightwood Ave., Chicago, explains the care and use of toolmakers' microscopes. It also presents the particular advantages of the Gaertner instruments which have a reputation for ruggedness of construction, simplicity of operation and accurate measurement.

DIE FILING AND ABRASIVE BELT FINISHING UNITS

A new bulletin by Armglo Co., 3520 W. Pierce St., Milwaukee, Wis., illustrates and describes the handy Armglo die filing machine which offers worthwhile economies on filing, laping and sawing dies, gauges, templates, cams, etc. Another bulletin introduces the Armglo Speedster, an abrasive band finisher for the sanding, surfacing, polishing and burring of castings, dies, stampings, die castings, moulded products, machine parts, etc.

ROLLER BEARINGS

Catalog No. 15 of the Shafer Bearing Corp., 35 E. Wacker Drive, Chicago, presents 85 pages of interesting and practical information on roller bearings. While primarily devoted to the Shafer line, a lot of useful engineering data is included. The heavy cover is attractive and serviceable. Illustrations are large, clear and numerous and the entire catalog reflects credit on its producers.

MODEL "C" LATHES

An attractive new 24-page catalog presents Pratt & Whitney's Model "C" lathes in their latest models — culmination of three-quarters of a century's experience in lathe building. Printed in silver bronze, red and black, the presentation is pleasing and convincing. Large illustrations present all of the details of the regular features and optional equipment and the text is easy to read. Copies may be obtained by addressing Pratt & Whitney, Division Niles - Bement - Pond Co., Hartford, Conn.

JUNIOR WELDING UNITS

Bulletin 336 gives a very intimate introduction to the Lincoln 200 ampere "Shield-Arc Junior," engine driven model. This compact machine, with a current range of 40 to 250 amperes is direct-connected to a 26 h.p. gasoline engine. The unit is mounted on heavy steel channel, substantially braced and can be used as a portable plant. A center double spread presents numerous illustrations of typical jobs on which these welders can be used to advantage.

Bulletin 308 presents the Lincoln 200 ampere "Shield-Arc Junior" with self-indicating dual continuous control. This is a compact motor-generator unit, mounted on an ingenious wheeled truck for ready portability. It embodies the Lincoln dual coninuous control and many advanced features.

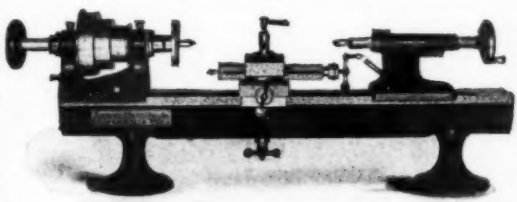
Address Lincoln Electric Company, Cleveland, Ohio for copies of the bulletins.

ROTARY FILES

Rotary files are meeting increasing acceptance in all kinds of finishing operations. M. A. Ford Mfg. Co., 413 Pershing Ave., Davenport, Ia., are prepared to furnish either hand cut or ground from the solid rotary files in many standard shapes and sizes, some of which are illustrated in a new bulletin No. 107.

REVOLVING WELDING TABLE

A complete description of the Ransome Revolving Tilting Welding Table is given in a new six page bulletin No. 160, with many illustrations of typical applications. Address Ransome Concrete Machinery Co., Dunellen, N. J., for a copy.



WADE
Bench Lathes

Economical, accurate, enduring for turning, drilling, threading, grinding, milling and screw machine operations.

Wade Tool Co.
Waltham, Mass.

Blue Book Buyers' Service

AVAILABLE TO OUR READERS

If you will list below the metal-working machines or machine shop equipment in which you are interested and mail to us, we shall be glad to refer your needs to the manufacturers or companies in position to serve you. Replies will come from them—not from us.

If you have any special engineering or shop problem with which you are experiencing difficulty, suggest that you send us full details for reference to our Engineering Service Department.

We are in the market for .....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Name .....

Address .....

Please check—

☐ Interested in new equipment.

☐ Interested only in used equipment.

Mail to the
HITCHCOCK PUBLISHING CO.
508 South Dearborn Street, Chicago, Ill.

Used and Rebuilt Machinery
Classified Section

Lists of Used and Rebuilt Machinery, either For Sale, Wanted, or For Exchange set in uniform style, will be published in the Classified Section at the rate of $5.00 for your name and address and a five line advertisement. For additional lines 40c per line.

Write directly to those offering the machine for sale, **for prices and full descriptions. If what you seek is not advertised, write Hitchcock Publishing Company Chicago, making known your wants on either new or used machinery and the publisher will gladly pass them along to the advertisers.**

FOR SALE BY
Aaron Machinery Co.,
176 Lafayette St., New York, N. Y.

Lathe, 24"x12' Boye & Emmes.
Lathe, Mueller 22x12'.
Lathe, Steinle geared head, turret, 8" hole spindle.
Lathe, Bullard 36", vertical turret, rapid production.
Millers, Becker vertical Nos 2, 2A, 5B, B-1.
Miller, Cincinnati No. 1 plain.
Miller, Cochrane-Bly No. 14 Dupiex, s. p. d.
Miller, Kempsmith No. 2 universal.
Nibbler, Campbell No. 1A.
Presses, hydraulic, pumps, accumulators.
Shapers, 16", 24", G. & E., Stockbridge.
Variable drives, Reeves, Lewellen.
Wheel press, 400 ton Caldwell hydraulic.

FOR SALE BY
Rosenkranz, Weisbecker & Company, Inc.
2308 Singer Building, New York, N. Y.

Boring mills, 84" Niles vert., rap. trav., m. d.
Drill, multiple spdl., No 30 Natco, m. d., 20" round hd.
Gear cutter, 110" Newton, motor drive.
Grinder, Cincinnati 24", face mill, motor drive.
Keyseater, No. 20 Catlin, m. d.
Lathe, 60"x25' Gleason, motor drive.
Lathe, 42"x18' Pittsburgh, quick change gear.
Planer, 72"x72"x32' N.-B.-P. 4 heads, rev, m. d.
Planer, 96"x72"x26' Pond. 3 heads, m. d.
Rolls, angle bending, 6"x6"x½" cap., m. d.

FOR SALE BY
Siegman Machinery Co., Inc.
563 W. Washington Blvd., Chicago, Ill.

Gear hobbers, Barber Colman No. 12, (8).
Grinder, Landis No. 2 universal.
Hob grinder, Harris.
Hydraulic, press, 400 ton, complete with pump.
Press, punch, No 7 Bliss Cons., b. g., m. d., 7½ h. p.
Radial, drill, Hamilton, 3½', gear box drive.
Screw machines, No. 5 Foster universal, power feed.
Shaper, bevel gear, 4 spindle, Gould & Eberhardt.
Spot welder, 100 KVA, Gibb, automatic head.
Swager, No. 3½ Langelier.
Turret lathes, J. & L., 2 spindle, steel geared heads, serial number over 50,000.

FOR SALE BY
Tranter Manufacturing Company
105 Water Street Pittsburgh, Pa

Band saws, 36", 32", belt drive.
Band saw, 16" Wallace, d. m. d.
Moulder—6", 4 side (Houston).
Moulder—8", 4 side (American).
Moulder—10", 4 side (Fay & Egan).
Saw, with c. s., all iron, top 32"x44".
Saw, no c. s., all iron, top 28"x35".
Shaper, Josias combination rip & crosscut saw and single spindle shaper, friction rev. c. s.
Swing saw, 4' arm.

All machines priced to move quickly.

FOR SALE BY
Standard Machinery Co.,
347 Indiana Ave. Grand Rapids, Mich

Automatic, 1½" Gridley, model F.
Boring mill, 42" Bullard vertical.
Boring mill, 2½" Lucas horizontal.
Drill grinder, Sellers 3" capacity.
Grinder, No. 2½ Walker surface.
Grinder, No. 4 Badger disc, motor drive.
Lathe, 24—42" Fifield Standard.
Lathes, Porter-Cable Mfg. (10).
Miller, model C-1 Becker heavy vertical.
Radial drill, Western, 4' arm.
Shaper, 24" Hamilton.

FOR SALE BY
Walter H. Meyer Machinery Co.
Noll Building, - Fort Wayne, Indiana

Die filing machine, floor type, P-4 Oliver, motor dr.
Drill, 6 spindle adjustable rail, No. 3 Foote Burt No. 4 M. T.
Grinder, 16"x72" Cincinnati, cylindrical or crankshaft
Lathes, geared head and cone drive, 9" to 60" swing.
Millers, plain and universal, horizontal and vertical.
Shear, beam Pels DT—42½-B, cap. beam and channel 2" to 20".
Shapers, planers, boring mills, radial drills, presses, shears, rolls, bulldozers, brakes, keyseaters, swagers, turret & screw machines.

JUST MAIL YOUR INQUIRIES.
We have over 1000 guaranteed machines to offer.

USED AND REBUILT MACHINERY

FOR SALE BY

The Lockwood Mfg. Co.

3170 Wasson Road, - Cincinnati, Ohio

Rotary vibrating riveters, No. 2A Grant, equipped with ½ h. p., 110/220 volt, 60 cycle, single phase horizontal motor, wrenches and flat table, (2).

FOR SALE BY

Reliance Machinery Sales Company

1405 Brighton Place, N.S. Pittsburgh, Pa.

Air compressor, 8x8 Chicago, 139 cu. ft.
Angle shear, H. & J. double, 6x6x1", on turntable.
Borer, car wheel, for 42" wheels.
Boring mill, 51" Bausch, 2 heads, rapid traverse.
Bulldozer, No. 9 W. W., 24" stroke, crosshead 16x894".
Drill, radial, 6 Reed-Prentice, s. p. d.
Grinder, No. 2 Brown & Sharpe surface, motor drive.
Miller, No. 4 Cincinnati, plain, cone.
Miller, No. 5 B. & S., plain, table 16"x54", cone.
Miller, No 6 Becker. 62" feed.
Planer, 36"x36"x12' Cincinnati, 2 heads.
Press, No. 2 Toledo, o. b. i., 4" stroke.
Press, consolidated, s. s., 5" shaft, 6½" stroke.
Press, No. 82-C Toledo dbl. crank, 5" shaft, 44" wide.
Presses, o. b. i., Nos. 4 & 5 Toledo.
Shapers, 16", 20" and 24", various makes.
Shear, open front bar, 7x1 flats.

What do you need? What have you for sale?

FOR SALE BY

Jones Machine Tool Company

Front & Pike Sts., Cincinnati, Ohio

LATHES

24"x20' Lodge & Shipley, q. c., cone drive.
18"x8' Monarch grd. head, motor drive.
16"x10' Lodge & Shipley q. c., cone drive.
18"x10' Hendey tie bar head, q. c., cone drive.
30x14' Hendey, tie bar head, q. c. cone drive.

MILLERS & GRINDERS

No. 3 Kempsmith plain c. d. — No. 2 W. & M. Grinder.
No. 2 hvy B. & S. plain c. d. — No. 3 W. & M. Grinder.
No. 25 hvy. Ohio univ. c. d. — No. 33 Abrasive m. d.
No. 4 Cincinnati, plain c. d.

PRESSES

No. 6-A Toledo, open back inclinable.
No. 6-H Toledo, open back inclinable, geared.
No. 17 Stoll open back inclinable.
No. 6A Toledo incl. back geared.
No. 7B Bliss, s. s. dbl. crank, tie rod frame, bed 60x34.
Michigan s. s., dbl Crank, 72" between housings.
All sizes inclinable and horning presses.

SHEARS

48"x16 gauge Queen City, 12" gap.
52"x10 gauge Niagara, 15" gap.
52" Niagara, 16 gauge, 15" gap.

MISCELLANEOUS

Boring mill, 42" King vertical.
Hack saws, 12x18 & 6x6 Racine; 6x6 Peerless.
Keyseater, No. 1 Davis motor drive.
Planer, 36x12 Gray, 2 heads.
Shapers, 17 & 21" Smith & Mills & 24" G. & E
4" Landis pipe machine.
11" Gleason bevel gear generator.

A LARGE STOCK ALWAYS ON HAND—
LET US HAVE YOUR INQUIRIES

FOR SALE BY

Porter-Cable Mche. Co., Syracuse, N. Y.

Automatic chucker, 6A Potter & Johnston, rebuilt.
Balancer, Gisholt dynamic, 24" swing x 40" length.
Milling machine, No. 24 B. & S., 6' table, good cond.

FOR SALE BY

Chas. E. Lowe Co.

174 Pearl Street Hartford, Conn.

½" Model G Gridleys, m. d.
1" Model G Gridleys, m. d.
1½" Model G Gridleys, m. d.
2" Model F Gridleys, m. d.
Nos. 24, 452 New Britain chuckers.
2", 4" Model "A" Clevelands, b. d.
2", 4" Model "A" Clevelands, var. m. d.
4" Model J, s. s. Gridley.
No. 00, No. 0, No. 2 Brown & Sharpe.
No. 53, No. 55 Acme, m. d.
40 sets of round collets and pushers for 1" G Gridley.

FOR SALE BY

Alex Zeeve

2280 Woolworth Bldg., New York, N. Y.

Drills, radial — 4' Dreses, gear-box motor drive; 3' American, gear-box single pulley drive.
Hammer, power, 400 lb. Beaudry "Champion".
Iron worker, combination universal, No. 16 Pels.
Lathes, 27"x14' Greaves-Klusman, q. c., 3-step cone, d. b. g.; 27"x24' Lodge & Davis, l. c. g.; 16"x6' Kimball-Walcott 12-spd grd. hd., s p.d.; others.
Shaper, 24" Stockbridge heavy duty b. g. cone, auto. down feed.
Shear, No. M-10 Marshalltown Throatless, a. c. motor drive, 10-gauge cap.

Let us have your inquiries.
We buy used machine tools.

FOR SALE BY

The Nutmeg State Machinery Corp.

1041 State St, - - New Haven, Conn.

Gear cutters, G. & E. No. 18.
Grinders, Heald No. 20—8" and 16" rotary.
Grinder, No. 10 Brown & Sharpe s. p. d., plain.
Grinders, Norton 6x32 and 10x36 plain.
Headers, No. 00 Manville, d. s. s. d., No. 00 s. s. s. d.
Header, Wat. Far. No. 0 d. s. s. d.
Lathe, Hendey 20"x12', yoke head.
Millers, Cin. Nos. 2 and 3 s. p. d., plain.
Miller, Cincinnati No. 3, cone, plain.
Miller, No. 1, Cincinnati universal complete.
Millers, Superior slot millers, m. d. (like new) (3).
Presses, No 3½-A toggle Bliss, No. 74½ Bliss.
Press, Baird No. 3 heavy, cut and carry.
Press, Wat. Farrel, 150 ton knuckle.
Press, No. 64, Cons. s. side, geared.
Rolling mill, 10"x8", Wat. Farrel.
Rolling mill, 4"x7", Buffalo.
Shaper, Potter & Johnson 15" m. d., univ.
Shapers, Springfield 18" m. d., (3).
Shapers, American 24" s. p. d.
Shaper, Cincinnati 24" m. d.
Tappers, Anderson dial feed, m. d.
Tappers, Hart & Heg. high speed, dial feed.
Many other lathes, presses, shapers, etc.

USED AND REBUILT MACHINERY

FOR SALE BY

Robert E. Harrison, Inc.

Amber, Willard & Collins Sts., - Phila.

Cake mixer, Reed vertical, 80 qt. Lot various size Osborn Economy wire wheel rehls.
Press, hydraulic, 15—15/16" ram, 30"x60" platens, 12" opening, complete with pump, motor, gauge & pipe.

FOR SALE BY

D. E. Dony Machinery Co.

47 Laurelton Rd., - Rochester, N. Y.

Automatics, ⅜" & 1¼" cone.
Chucker, No. 484 New Britain.
Degreaser, Rex Model No. 3-D.
Die casting machines, No 4 & No. 5 Madison-Kipp.
Thread millers, Holden-Morgan.

FOR SALE BY

Davis Machinery Company

1-3-5 So. St. Clair St. Toledo, Ohio

Brake, 4'x3/16" Chicago, power, leaf type, m. d.
Gear hobber, No. 12 Barber-C., dbl. over-a. rapid-trav.
Milling machine, No. 3 Cin. univ., hi. p., div. hd.
Milling machine, No. 3 Kempsmith, univ. div. hd.
Thread miller, 6"x12" Pratt & Whitney, belt drive.

FOR SALE BY

Bleser Machinery Company

209 N. Sixteenth St., - Springfield, Ill.

Chain hoists, Yale 4 and 5 ton capacity.
Lathe, 16"x8' South Bend, milling attachment .... $ 225
Lathe, 36"x18' L. & S., q. c., arranged m. d..... 1500
Shaper, 32" American, arranged motor drive 325
Trip hammer, 25 lb. Little Giant..... 75

FOR SALE BY

Marr-Galbreath Machinery Company

57 Water St., Pittsburgh, Pa.

Air compressors, 7½x8" Chicago, NSB.
Air compressors, 9x8" Sullivan, WG-6.
Blowers, (furnace) No. 2 Knight; No. 3 American.
Blower, pressure, No. 11-PB Am. 14375 cfm., m. d.
Bolt cutters, 1" Greenfield, 1½" Landi .
Boring mill, 30" Bullard vert., threading attach., b. d.
Brake, 6'x18 ga. PS & W. hand
Brake, 8'x12 ga. Chicago, power, belted.
Brake, crimp and corrugating, 10'x16 ga. Keene.
Drill, radial 2½" Bickford g. b., m. d.
Drill, 3' radial, Dreses rd. swing table, t. a.
Drills, gang, 3 and 4 spindle, 1 to 4 MT.
Exhauster, No. 35 Buffalo, outlet 12x14", m. d.
Fan, ventilating, 24" American, m. d., 1/60.
Fan, 2½ Sirocco, 4960 cfm. 4" wp., m. d.
Forging machine, 1½" Acme, all steel, side shear.
Furnace, gas fired, Tate-Jones "GOF", I. D. 16½"x11".
Furnace, T-J., 25x23x12" I D. 17000 f.
Grinder, No. 10 B, & S., plain, s. p. d.
Grinder, plain No. 10 B. & S., s. p. d., collet att.
Grinder, No. 21 Landis, plain, 10x30", c. s.
Grinder, tool & cutter No. 1½ Cincinnati, plain,
Grinder, portable surface, No. 6-OA. motor, 3/60.
Grinder, univ. C. & K. No. 3 B. & S.
Grinding spindle, Excello No. 39, bracket 5002.
Hack saw, No. 2 Marvel; No. 14-S. Atkins.
Hammers, 50 lb. Boss, No. 2, with dies, belted.
Hammer, 100 lb. Little Giant, belted.
Hammer, 200 lb. Bradley upright helve, motor drive.
Hammer, 300 lb. Beaudry "Champion", b. d.
Hammer, 400 lb. Bliss board drop (rebuilt).
Hammer, 1000 lb. Chbg. steam drop, double frame.
Hoist, chain, 1, 1½, 2 & 5-ton, hand
Hoists, 10-ton Euclid, 3/60/220 (2).
Keyseater, Morton, cap. 2½"x24", s. p. d.
Lathe, 7½x30", Dalton, type B-4, screw cutting.
Lathe, 15/32"x8' Sebastian gap bed cone.
Lathe, 16/32"x8' Fay & Scott, slidingc bed, gap, cone.
Lathe, 18"x8' L. & S., d. b. g., Cullman, m. d.
Lathe, 18"x10' South Bend., plain change.
Lathe, 20"x8' Le Blond q. c. g., 5-step cone.
Lathe, 20"x12' American geared head, m. d.
Lathe, 22"x12' Rahn-Larmon, pl. change gears, t.a.
Lathe, 27"x10' L. & S., 5-step cone, q. c. g.
Lathe, 24"x20' L. & S. selective head, m. d., t, a.
Lathe, 26"x10' Wolcott, q. c. g., d. b. g., 2½" h. s.
Marking machine, No. 3 Noble & Westbrook.
Miller, hand., No. 2 Kempsmith.
Milling machine, univ. No. 4 B. & S. cone.
Milling machine, pl. No. 3 Cincinnati, cone.
Nailing machine, No. 6 Morgan, 8-track, m. d.
Nibbling machine, No. 1 Campbell, 6" thr. 3/16".
Nut runner, No. 4 B. & D. ⅜", motor 110 v.
Pinion cutter, No. 3 Sloan & Chase, capacity 1x1".
Pipe machine, 4" Williams, cap. ⅜" to 4", m. d.
Pipe machine, 18" Wieland "Standard", m. d.
Planer, 26"x26"x8' Niles, 1 hd., belt m. d.
Planer, 30"x30"x8' Cincinnati, 1-rail, 1-s. h., m. d,
Presses, 6 & 7 Bliss d. c., t. r., b. g.
Presses, No. 18 Bliss, o. b. i., 1½ & 2" stroke.
Press, hyd. vert., 30-ton Lourie, 18" between posts.
Press, foot, Lewthwaite, wt. 400 lb., (2).
Press, horn, No. 16½ Bliss, plain, stroke 1½".
Presses, United, 56-ton o. b., str. 1½", shear blade., m.d.
Press, o. b. i. No. 0 Thomas, 1½" str., 650 lb. (new).
Press, o. b. No. 3 Perkins, pl. str., 1½".
Press, o. b. i. No. 1 Thomas, 2" stroke, m. d.
Press, punch, P-2, Ferracute, m. d.
Press, punch type, No. 5 Bliss, plain.
Press, sgl. crank, 60½ Toledo, str. 6".
Press, wheel, 60-ton W-S., 34"x8½".
Press, wheel, 200-ton, 93"x16', pump, m. d.
Punch, bench, Niagara, 6" throat, ½"x½".
Punch & shr., comb., No. 5 Buffalo, hand, cap. ½"x½".
Punch & shear, S. E., 15"c ht. ½"x½"; No. 3 L. & A.
Riveter, No. 103 Grant, motor drive.
Riveters, No. 3-A. and 120 Grant, m. d.
Riveter, No. 5-A, high speed, cap. ½", m. d.
Rolls, 30"x6" United, 2-rolls (for leather).
Saws, metal, 4x4" Napier, m. d., (2).
Screw machine, turret No. 1 Garvin, w. f.
Shaper, 15" Blount, (planer drive).
Shaper, 20" Kelly, b. g. crank, cone.
Shaper, 21" Averbeck, b. g., cone.
Shaper, 24" Milwaukee b. g., V-ram.
Shaper, 24" American, gear box, motor 3/60/220.
Shaper, 28" American b. g., gear box. m. d.
Shear, alligator, 18", 8" blade.
Shear, alligator, No. 46 Beloit, cap. 1".
Shear, B-36 Stanley Unishear, cap. ½", m. d.
Shear, O-36 Stanley Unishear, cap. 14 ga., m. d.
Slotter, 3½" Rhodes, bench, rotary table.
Speed reducers, 1 h. p., 98:1; 3 h. p. 41:1.
Sprue cutter, No. 172 Bliss, belt
Tapping machine, ½" Pratt & Whitney, b. d.
Testing machine, 1000 lb. Olsen hyd., hand.
Testing machine, 100,000 lb. Riehle, m. d.
Tiering machines, 600 and 1000 lb. Economy, hand.
Tumbling barrel, No. 2 Baird, tilting.
Turret lathe, 24"x14" Gisholt.
Turret lathe, 34"x36" Acme, s. p. d.
Turret lathe, 18"x6' Springfield, Fox Monitor.
Upsetter, 1½" Acme, all steel.
Welder, arc, 280 amp., a. c. Hampton (new).

USED AND REBUILT MACHINERY

FOR SALE BY

Wilmington Fibre Specialty Company

P. O. Drawer 1028 - Wilmington, Dela.

Lathe, Adams Short Cut, 12" swing, 24" length, with taper attachment. In first class condition. Spindle and bearings practically new.

FOR SALE BY

Industrial Machinery Company, Inc.

2200-2300 Fletcher Av. Indianapolis, Ind.

Turret lathe, No. 2 Acme full universal, m. d. 3-60-220.

FOR SALE BY

Wigglesworth Machinery Co.

199 Bent Street Cambridge, Mass.

Boring mill, 3" bar Lucas.
Boring mill, 24" Bullard, side head.
Drill, 4-spindle Leland-Gifford.
Grinder, No. 1½ Landis, universal.
Grinder, 14" model B, Pratt & Whitney, m. d.
Grinder, No. 33 abrasive, m. d.
Grinder, No. 16 Blanchard, m. d.
Grinder, No. 2 Brown & Sharpe—Reid.
Grinder, 18"x96" Norton.
Lathe, 16"x12' Walcott, q. c. g.
Lathe, 18"x12' Rockford, q. c. g.
Miller, No. 2 Brown & Sharpe. (2).
Miller, No. 2 Cincinnati hi power, s. p. d.
Miller, No. 2 Kempsmith universal.
Miller, No. 3A heavy Brown & Sharpe univ., m. d.
Miller, No. 4 Knight—jig borer—m. d.
Planers, 42"x42"x10' Detrick & Harvey (2).
Press, No. 3 V & O, back geared, m. d.
Radial, 4' American triple purpose, m. d.
Radial, 4' Cincinnati-Bickford, s. p. d., enc. head.
Spline millers, 6" Taylor & Fenn (4) m. d.
Spline miller, 4" Pratt & Whitney.
Turret lathes, No. 2A & No. 3A Warner & Swasey.
Turret lathe, No. 3 Foster, timken bearing, m. d.
Turret lathe, No. 4 Brown & Sharpe, wire feed.

Send for Complete List.

FOR SALE BY

Russell Machine Co.

438 Oliver Bldg. Pittsburgh, Pa.

Boring mill, Bullard, 42" New Era type.
Boring mill, 42" Gisholt, 2 heads., m. d.
Boring mill, 10' Niles vertical.
Gear hobber, No. 18H Gould & Eberhardt, s. p. d.
Hammer, 50001b. double frame NBP steam.
Lathe, 26"x13' Chard, hvy. duty, q. c. g., t. a.
Lathe, 26—48"x14' McCabe 2-in-1 l. c. g., b. d.
Lathe, 52"x23' Pond triple geared.
Lathe, turret, 36" Steinle, 8" h. s.
Pipe cutting and threading machine 6" Merrill.
Planer, Cincinnati 36"x36"x10' table.
Press, No. 5 Bliss type, 2" stroke, b. d.
Press, wheel, 200-ton Niles, b. d.
Punch-press Cleveland grd. roller feed, 100 ton pr.
Shaper, 24" Gould & Eberhardt.
Shaper; 24" Columbia, d. b. g., gear box, m. d.
Shear, alligator, United, cap. 5/8" square.
Shear, plate, No. 5 H. & J., cap. 90"x½", m. d.
Sprue cutter, No 7 Z. & H. m. d., cap. 1¼" dia.
Upsetting machines. 2½, 3½, 4 and 5" Ajax iron bed.

FOR SALE BY

Wisconsin Gear & Engineering Co., Inc.

602 So. 2nd Street, - Milwaukee, Wis.

Bilgram Bevel Gear Generators

Guaranteed to be in A-1 condition with all change gears and segments.

FOR SALE BY

Joseph Hyman & Sons,

Tioga and Almond Sts., Philadelphia, Pa.

WORLD'S LARGEST STOCK

POWER PRESSES

No. 206C Toledo, gap, dbl. crank, tie rod, 6½"—7" crank.
No. SG 115 Ferracute, dbl. crank, tie rod" 69", crk. 5½".
No. 5C Bliss (2) double crank, tie rod, 84", crk. 5" 5½".
Bliss double crank, gap, grd. 7½" crank, bed 97"x18".
No. 138 Bliss, double crank, flywheel, 79", crank 5".
Nos. 93B, 92D, 91C Toledo dbl. crank presses.
Nos. 54, 55, 57, 57A, 59½ Toledo, geared straight side.
No. 58A Toledo, geared, straight side.
No. 512 Niagara, geared, straight side, 6½" shaft.
No. 58G Garrison, tie rod, straight side, 8" crank.
Nos 5S, & 3½C tie rod Bliss toggle presses.
No. 168½ Toledo toggle, tie rod.
No. 164½ Toledo and No. 5 Bliss toggle presses.
No. 910B Stoll, toggle press, 7" 8" crank, 8½" draw.
No. 40 & 39B Bliss, Nos. 14 & 13 Toledo horning.
No. 662 Toledo, 250 ton knuckle joint, coining.
150 ton No. FWG 52 Ferracute, 75 ton EG 51 Ferracute.
500 ton American Can Coining, 75t. No. E51, Ferracute.
200 ton No. 59 Bliss, 250 ton Waterbury F, coining.
100 ton No. 21 Bliss, 50 ton No. 3 Bliss coining.
No. 3W Bliss wiring presses, (2).
Squaring shears, various sizes.
Gang slitter, 60", Braddock, type H.

These and hundreds of others of popular makes and sizes, are in stock at our warehouse here.

Rebuilt and Guaranteed.

FOR SALE BY

Failor-Strafer Machinery Co.

132 Liberty St., - - New York, N. Y.

Boring mill, 42" Bullard "New Era".
Drills, 3½' Cincinnati-Bickford radials, s. p. d.
Drill radial, Amer. 3' sens., tapping attachment.
Gas furnace, No 4 American, door opening 8"x14".
Grinder, No. 14 Pratt & Whitney b. b., vert. surface.
Grinder, No. 16 Blanchard high power vert. sur., m. d.
Grinder, Oliver 4 wheel wood tool grinder.
Hammer, No. 4-B Nazel, motor drive, a. c.
Lathe, 17"x8' LeBlond heavy duty, 3 step cone, d.b.g.
Lathe, 18"x8' Lodge & Shipley, geared head.
Lathes, 18"x14½' and 16"x10' Lodge & Shipleys.
Lathe, 20"x9' Cleveland, geared head.
Lathe, 26"x14' Lodge & Shipley, taper attachment.
Lathes, 2½"x24" and 3"x36" J. & L., bar equipt.
Lathes, 2½x24" and 3"x36" Acme, g. h., bar equipt.
Lathe, turret, No. 3 A Warner & S., chucking equipt.
Miller, plain No. 24 B. & S., table work surf. 72"x13½".
Miller, No. 1 Cincinnati plain, cone drive.
Millers, No. 2 Cincinnati plain, high power, s. p. d.
Miller, 48" Cincinnati automatic duplex, motor drive.
Multiple punch, No. 5 H. & J., 84" between housings.
Pipe machine, 4" Williams, motor drive.
Shears, squaring 10'x¼" and 12'x3/16" Ohl.
Shear, squaring 10'x3/16" Loy & Nawrath, arr. m. d.

USED AND REBUILT MACHINERY

FOR SALE BY

Mayer Machinery Co.
742 Osage Street Fort Wayne, Ind.

Air compressor, Ingersoll-Rand, 475 cfm., syn., b. m. d.
Air compressor, Worthington, 14x12, syn. b., m. d.
Air compressor, Worthington, 15x16, Duplex, 1420 cfm.
Air compressor, Curtis 9x9 & 8x8, Duplex.
Automatics, 1¼", 1¾", 3 5/16" model G, m. d.
Potter & Johnson 5A and 6A, m. d.
Lathes, Prentice, 14x6, 16x8, 18x8, grd. hd., m. d.
Press, 85½ Toledo, tie rod, roll feed, m. d.
Press, Lucas 15 ton forcing, m. d.

FOR SALE BY

B. D. Brooks Co., Inc.
119 Broad St. Boston, Mass.

Sheet metal working machinery, hand and power.
All types of new and reconditioned equipment.
Apron brakes, press brakes, shears, folders,
Bending rolls, corrugating rolls, forming rolls,
Punches, beaders, rotary machines, stakes, etc.

FOR SALE BY

C. R. Daniels
1514 W. Capitol Drive, Milwaukee, Wis.

Bolt cutter, Landis, two spindle, 1" capacity.
Brake, Chicago steel bending, ½"x4' capacity.
Drill, 24" Defiance, 3" cap. box column, s. p. d.
Grinder, No. 12 Bryant chucking, with sizing equipt.
Saw, No. 2 Ryerson friction with a. c. motor.

FOR SALE BY

Surplus Stock & Machinery Co.,
620 W. Lake St., - Chicago, Ill.

Dieing machine, 25 ton Henry & Wright, roll feed.
Grinders, surface, No. 2 Brown & Sharpe, motor dr.
Lathe, 16"x6' South Bend, q. c. g., motor driven.
Lathes, 16"x8', 18"x8' American, quick change gear.
Milling machine, No. 1½ Brown & Sharpe, fully equip.
Shaper, 14" Gould & Eberhardt, high duty, back grd.
Shaper planer, 26" openside, s. p. d., power feeds.
Complete stock of metal working machinery.
Send us your inquiries.

FOR SALE BY

Lang Machinery Company 28th St. & A. V. R. R. Pittsburg, Pa.

Air compressors, Ingersoll-Rand XB-2, 600, 888, 1200 & 1500 cu. ft. 100 lb. pressure, motor drive.
Air comp., W N31 Sullivan, 350 c. f. syn. m. d.
Air compressors, (2) Sullivan, 480 c. f. 100 lb. b. m. d.
Air comp., 14"x12" Ing. Rand "ER-1", 464 c. f.
Automatic, model "C" National Acme, 1¼", m. d.
Bolt cutter, 1" Landis, 1¼"-3" Acme, sgl. hd., b. d.
Boring mill, 24" Bullard, rapid production, m. d.
Boring mill, 30" Bullard, threading attach., s. p. d.
Boring mill, 42" Bullard, 2 swivel heads, s. p. d.
Boring mills, 42" Bullard "New Era", m. d. (2)
Boring mill, 42" Gisholt, 2 hds., r. p. t., m. d.
Boring mill, 42" Bullard, rapid production, m. d.
Boring mill, 52" Bausch, geared feeds, d. c., m. d.
Boring mill, 84" Pond, 2 heads, belt drive.
Boring mill, 96" Betts, rapid traverse, m. d.
Boring mill, 10' Niles, 2 heads, belt drive.
Boring mill, floor type, 3" bar Niles, m. d.
Brakes, power, 7' 10 ga., 8' 12 ga., D. & K.
Buffer and polisher, 7½ h. p. Marschke, 220/3/60.
Cranes, (2) 5-ton Shaw, EOT., 50' span. 3 mtr.
Drill, heavy duty No. 1 Baker, 24" capacity 2¾", s. p. d.
Drills, radial, 2½' Cincinnati-Bickford, m. d.
Drills, radial, 3' Fosdick, s. p. d.
Drill, radial, 3½' Cincinnati Bickford, t. a., s. p. d.
Drills, upright, 14" to 32", belt drive.
Drills, 4-spdl. Avey No. 4, b. b., m. d.
Gear cutter, 48"x12" Gould & Eberhardt, s. p. d.
Gear hobber, No. 18-H Gould & Eberhardt, s. p. d.
Gear hobber, 96"x30" Gould & Eberhardt, m. d.
Generator, 50 KW Westinghouse, 75 h. p., a. c.
Grinder, disc, 18" Diamond, dbl. end.
Grinder, disc, No. 6—20 Besley, a. c., m. d.
Grinder, surface, No. 5 Grand Rapids, hyd. feed, m. d.
Grinder, T. & C. No. 2 Norton, belt drive.
Hammer, 100 lb. Bradley cushion helve belt drive.
Hammer, power, 300-lb. Bradley upright helve.
Keyseaters, M. & M. No. 0—1", No. 4—2¾", No. 5—3¼".
Keyseater, No. 2 Baker, str. 24", cap. 2", b. d.
Keyseater, Baker, 36" stroke, 3½" m. d.
Lathe, 12"x6' Prentice, geared head, q. c. g., s. p. d.
Lathe, 16"x8' Hendey, q. c. g., t. a., b. d.
Lathe, 20"x8' S.—B. & K., q. c. g., b. d.
Lathe, 20"x24' Lodge & Shipley, q. c. g., b. d.
Lathe, 21"x8' LeBlond, q. c. g., a. c., m. d.
Lathe, 21"x10' LeBlond auto. mfg., belt drive.
Lathe, 24"x10' Bradford, q. c. g., t. a., b. d.
Lathe, 24"x14' Schumacher & Boye, q. c. g., b. d.
Lathe, 24"x14' Lodge & Shipley, q. c. g., d. b. g., b. d.
Lathe, 24"x16' Lodge & Shipley, q. c. g., t. a., m. d.
Lathe, 28"x14' Schumacher & Boye, p. c. g., t. a., b. d.
Lathe, 36"x18' American, p. c. g., t. a., b. d.
Lathe, 51"x32' New Haven, triple geared, motor drive.
Lathe, turret, No. 2 Warner & Swasey, b. d.
Lathe, turret 30" Steinle, grd. hd., 8" h. s., m. d.
Miller, hand, No. 6 Whitney, b. d.
Miller, plain, No. 0 Brown & Sharpe, b. d.
Miller, plain No. 1½ Brown & Sharpe, grd. feeds, b. d.
Miller, plain, No. 2 Cincinnati, tbl. 46-¾"x10", b. d.
Miller, plain, No. 2 Hendey-Norton, b. d.
Miller, plain, No. 2½ LeBlond, tbl. 52"x11-¾", b.d.
Miller, plain No. 2S Ohio, table 52"x11-¼", belt drive.
Miller, plain, No. 3 Cincinnati, b. d.
Miller, plain No. 4 LeBlond, table 72"x16", belt drive.
Miller, plain, No. 24 Brown & S. tbl. 80"x17½" b. d.
Miller, Mfg. Type, No. 2-A Milwaukee, s. p. d.
Miller, vertical, model "B" Becker tbl. 57"x12", s.p.d.
Pipe machines, Landis ½" to 2", belt drive, (2).
Pipe machines, Nos. 304-B, 306-A 308-A Oster, m. d.
Pipe machine, 8" Williams, 2½" to 8" motor drive.
Pipe machine, No. 11½ Merrill, 2½" to 12", motor drive.
Planer, 30"x30"x8' Niles-Bement-Pond, m. d.
Planers, 36"x36"x10' Cincinnati, 2 heads, belt drive.
Planer, 72"x72"x14' N.-B.-P., 4 heads, rev. m. d.
Planer, openside, 48"x48"x12' D. & H. 3 hds., m. d.
Press, arch, No. 52 Toledo, str. 4½", m. d.
Press, No. 95 Bliss, dbl. crk., str. 3½", m. d.
Press, No. 83 Cleveland, stroke, 2½", roller feed, m. d.
Press, toggle, No. 3½-A Bliss, stand.
Presses, wheel, 100, 200 & 250-ton Hydraulic.
Profilers, Nos. E3 and E4 Keller, motor drive.
Punch & S., Cleveland, 36" thrt., 1½"—1", m. d.
Punch 26" Deep Throat, b. d.
Riveting hammer, No. 5½B high speed, m. d.
Roll, bending, 7'x¼", Pyramid Type, b. d.
Shapers, 16", 20", 24" & 28", belt or motor drive.
Shaper, 24" Columbia, d. b. g., gear box, m. d.
Shaper, openside, 26" Universal, Type A, m. d.
Shear, No. 1½ Canton alligator, 2½" square, m. d.
Shear, Alligator, No. 7 United Eng. & Fdy. Co.
Shear, billet, No. FV-23 Pels, 3" round cap., m. d.
Shear, rotary, No. 10 Quickwork, 14 ga. 60° throat.
Shear, plate, No. 5 H. & J., 90"x¼"—36" throat, m. d.
Slotter, 8" Betts, table 20" dia. b.d.
Slotter, draw stroke, Baker, cap. 3¼"x38", m. d.
Straightener, No. 1 Kane & Roach cap., ¾" rd. m. d.
Welders, 200 amp. Gen. Elec.—300 amp. Lincoln.

USED AND REBUILT MACHINERY

FOR SALE BY

Wachs-Gregg & Company
1535 Dayton Street Chicago

Crank shaper, 24" Rockford, b. g., belt or motor drive.
Drill, 3' Cincinnati-Bickford, plain radial.
Drill, 4' Hammond sensitive radial.
Lathe, 36" Gisholt turret, 230 V. D.C., motor drive.
Milling machine, No. 4 Cincinnati plain cone type.
Planer, 48"x14' Cleveland open side, 2 heads mtr. dr.
Planer, 48"x48"x12' Belmer, 2 heads.
Screw machine, No. 4 Acme, cone type.

FOR SALE BY

Acme Equipment Company
128 So. Clinton St., - Chicago, Ill.

Apron brake, Chicago steel power, 4 ft., ¼" cap.
Boring mill, 42" Colburn.
Drills, radial, 2½, 3, 3½, 4 ft. arms.
Grinder, Gardner 53" horizontal, b. b., m. d.
Lathe, 21"x10' LeBlond, heavy duty.
Milling machine, No. 2 Rockford, universal.
Presses, punch, o b.i. No. 00, 0, 1, 2, 3, 4.
Shapers, 14, 16, 18, 20, 24" stroke.
Turret lathes, Libby, 18" & 26" swing.

FOR SALE BY

Moser Machine Tool Sales
3250 North 54th St. Milwaukee, Wis.

Automatic, No. 0G B. & S. h. s., 220 v, m. d., 98% new, 60 day's service.
Automatic, Fay 14"x19" centers, 10 h. p., 220 v. motor.
Balancing machine, No. 3 C Tinius Olsen dynamic and static bal., motor driven.
Boring mill, Bullard 28" vert. index turret, b. d.
Chuckers, New Britain, No. 24 & 33, b. d.
Drill, No. 4 Bausch 28-spindle multiple b. d.
Drill, No. 00S Garvin dbl. end hor. ¼" cap., p. f.
Gear hobber, No. 1 Schuchardt & Schutte c. a. b. d.
Grinder, dr. 3" No. 51 Oliver, 220 V. m. d.
Grinder, No. 65 Heald int.
Grinder, No. 12 Bryant int., 220 V., m. d., gages, etc.
Grinder, 12"x36" Landis, b. d. complete.
Grinder, Norton 16"x30" dbl. end dr. crankshaft b. d.
Grinder, No. 1, Gardner dbl. end motor on spindle, univ., 220 V, pan, pump and piping, pract. new.
Lathe, 20"x8' Amer., a. g. h.
Lathe, 24" Gisholt Simplimatic, 15 h. p., 220 V. motor; pract. new.
Miller, No. 1 U. S. hd., b. d.
Miller, 23"x33" Putnam L type p. f., b. d.
Milling machine, No. 0 Owens, 3-step cone, b.p.f., c/s.
Milling machine, No. 12 Garvin, p. f. to table, b. d.
Milling machine, No. 2 Cin. pl., a. p. d.
Radial drill, 2'-8" col. Amer. pl., gear box, a. p. d.
Radial drill, 3'-9" dia. col. Morris pl., 12 spdl. speeds, g. b., a. p. d.
Radial drill, 4'-11" dia. col. Amer. trip. gd., 24 spdl. speeds, c. b., a. p. d.
Screw mach., No. 1 & 2 W. & S. hd., a. c. & b. f., b. d.
Screw mach., No. 0 B. & S. hd., wire feed.
Screw mach., No. 2 B. & S. hd., wire feed.
Screw mach.; No. 3 W. & S. hd., p. f. to t., air chucks.
Screw mach., No. 6 B. & S. hd., p. f. to t., a. c.
Turret lathe, No. 2-A W. & S. univ. chucking machine, fact. reb.
Turret lathe, Greenlee 2½"x76" flat, auto. chuck, a p.d.
Turret lathe, Gisholt 24" d. b. g. 4-jaw chuck, b. d.
Turret lathe, 26" Libby type C H. D., a. p. d.
Univ. No. 4 Gisholt a. c. & b. f., m. d.
Welder, butt, 20 k. v. a., Thompson, cap. ¾" rd. stock.
Wire str., F. B. Schuster, ¾" cap., excellent condition.

FOR SALE BY

The Reeve-Fritts Company
28 N. Clinton St., Chicago

Boring machine, No. 1 Barrett, cylinder.
Cut-off machine, 12" Peter's abrasive.
Gear hobber, No. 1 Adams Farwell.
Press, arbor, No. 3 Greenerd.
Press, No. 3 Bliss (solid back).
Press, No. 36 Bliss arch.
Saw, cold, Lea-Simplex, 5½".
Screw driver, No. 2 Reynolds.
Screw machine, ¾" Cleveland automatic.
Tapper, No. 1 Garvin, ¾" vertical.

FOR SALE BY

Segal Machinery Company
117 S. Clinton St., - Chicago, Ill.

Automatics: 5A & 6A Potter & Johnston and Fay's.
Broaches, V-18 American; Nos. 1 and 3 LaPointe.
Gear hobbers, No. 3 & No. 12 Barber-Colman, m. d.
Grinder, No. 33 Abrasive, mot. dr., 5" cup wheel.
Lathes, 12x5, 14x6, 16x8, 20x8, Mon-LeBlond—q. c. g.
Millers, No. 2 B. & S. & Kemp, univ., fully equipped.
No. 2 Garvin duplex; 24" Cincinnati duplex.
Nibblers, Nos. 1½ & 3 Campbell, ¾" cap. 24" throat.
Planers; 30x30x8 Cinc. 30x30x6 openside, Det. & Har.
Punch presses: No. 42 Toledo horn; No. 540 Max. Ams. str. sid.—Back Gear, 8" stroke. No. 4 Bliss-Con.
Screw machines, No. 4 & 6 W. & S., Plain & universal.
Shapers, 16", 20", 24", 28", G. & E., Mil. and Amer.
20" Rockford, hy-service, motor drive.
Swedger, No. 4 Langeller, power infeed.

Partial list — Send us your inquiries.

FOR SALE BY

Wm. C. Johnson & Sons Machy. Co.
1211 Hadley St., St. Louis, Mo.

Air compressors, 15 in stock.
Automatic, cone, 1", 1½", 4 spindle, complete.
Bolt threaders, 1", 1½" & 2" Acme.
Boring machine, 4½" Betts.
Boring mills, 6'—8', 44" Niles.
Drill, Allen 4 spindle, No. 3 taper, 12" overhang.
Drill, No. 2 Fox, 6 spindles.
Drill, Moline hole hog, 5-sp. No. 4 Morse taper.
Drill, radial, 4' Dreses and 4' Foodick; 3½' Mueller.
Gear hobber, No. 3 Adams.
Hammers, 300 lb. Beaudry, 75 lb. Bradley, 50 & 100 lb. Little Giant.
Lathe, 14"x6' Hendey belted m. d. taper attach.
Lathe, 18"x8' Boye & Emmes, q. c.
Lathe, 27"x16' L. & S. q. c. g.
Miller, Cin. production type, 57"x11" table.
Miller, Pratt & Whitney, spline.
Miller, No. 4 LeBlonde universal cone drive.
Pipe machines, 3"—4"—6"—8"—12".
Presses, Nos. 2, 3 & 4 Marshalltown.
Presses, 3, hydraulic pump & accumulator.
Press brake, 10' for 10 ga. Obl.
Press brake, 8' 6" for 14 ga. m. d., 95% new.
Punch, Cleveland E. F. art jaw, 47" thr., with Lyaholm spacing table, m. d., one-man control.
Rolls, corrugating, 24" dia., 12' removable dies.
Roll, plate straightening, H. & J. No. 2, like new.
Saw, 12"x12" Racine and Nos. 2 & 1 Marvels.
Shapers, 12"—16"—20"—24".
Sq. shear, No. 499 Bliss, 10'.
Punches, shears, bulldozers.
Testing machine, 100,000 lb. Riehle.
Large stock guaranteed electric motors. Any size.

SEE OUR OTHER ADD ON PAGE 190

USED AND REBUILT MACHINERY

FOR SALE BY

General Blower Company

401 N. Peoria St., - Chicago, Ill.

BLOWERS—FANS—EXHAUSTERS.
For Dust Collecting — Ventilating.
Oil and gas burners, cupolas, furnaces, etc.
Roots—Connersville and centrifugal blowers.
What are your blower requirements?

FOR SALE BY

E. L. Klauber Machinery Co.

3221 Olive St. - - St. Louis, Mo.

Automatic, Cleveland Model A, ⅜"—1¼ capacity.
Engraving machine, No 1 A Gorton, motor drive.
Milling machines, No. 0Y Brown & Sharpe.
Presses, No. 35 Swaine o.b.i., No. 1 Perkins notching.
Shaper, 24" Cincinnati, universal tool room.

FOR SALE BY

Advance Machinery Co.

1032 W. Somers St. Milwaukee, Wis.

Gear hobber, No. 12 Barber-Colman.
Grinder, 6"x16" Ott cylindrical.
Grinder, 6"x32" Norton cylindrical.
Grinder, surface, No. 3 Wilmarth & M.
Lathe, 14"x6' Carrol-Jamieson, q. c.
Lathe, No. 4 Warner & Swasey, universal.
Miller, No. 1 Kempsmith plain.
Miller, No. 2 Cincinnati high duty.
Miller, No. 6 Becker vertical.
Shaper, 24" Milwaukee, b. g. crank.

FOR SALE BY

Nelson Machinery Co., Green Bay, Wis.

Bolt cutter, 2½" National geared head, motor drive.
Grinder, Cochrane Bly No. 11S auto. saw, cap. 10" to 32".
Hobber, Barber Colman No. 12.
Lathe, 16"x16' South Bend, LC-SBG, reg. equip.
Lathe, 18x8 Schumacker, SBG-LC, cab. legs, reg. equip.
Lathe, 18x8 Reed SBG-LC, reg. equip. and taper att.
Miller, No. 10 Pratt & Whitney.
Pipe threader, No. 6 Bignall & Keeler, dup. improved, 1½ to 6".
Press, No. 21 Bliss OBI, 2" stroke.
Shaper, 16" Milwaukee, hol. ram, vee slide.

FOR SALE BY

West Penn Machinery Company

1210 House Building, Pittsburgh, Pa

Air compressors, 30 to 2500 cubic feet.
Air compr. portable gas 1-R 180 cu. ft.
Blower, No. 4 Roots, capacity 2110 c. f. m.
Bolt cutters, 2" & 3" Acme, b. d.
Boring mill, 36" Bullard, side head.
Boring mill, 42" Bullard, 2 heads.
Boring mill, 66" Betts, 2 heads, belt drive.
Bulldozers, Nos. 2, 4, 6, 9, 28, & 30.
Crane, 10 ton Whiting, 43' Span, 220 d. c.
Crusher, jaw, No. 4 Champion, b. d.
Drill, 4' radial, Morris, speed box.
Drill, radial 6' Reed-Prentice, single pulley drive.
Drills, 4 spindle Avey, No. 2 m. t., s. p. d.
Drills, upright 10" to 36".
Engine, gas, 20 horse power Bessemer.
Flanger, McCabe, 4" capacity, dies.
Gear cutters, Nos. 5 & 6 B. & S., 60" & 72" m. d.
Gear cutters, 11", 18" & 24" Gleason.
Gear tester, bevel 18" Gleason.
Grinders, centerless Heim, m. d., 220/3/60.
Grinder, drill, No. 31 Oliver, 1½", m. d., 220/3/60.
Grinder, knife 10' Bridgeport, m.d.
Grinder, roll, Farrel 28"x76".
Grinders, D. E. 2—3 & 5 h. p., 220/3/60.
Grinder, T. & C. No. 1 & No. 2 Cincinnati, m. d.
Grinder, disc, No. 8—20" Besly, belt drive.
Grinder, disc, No. 4 Gardner, motor drive, 220/3/60.
Groover, No. 275-A Niagara, 6", 16 ga. motor drive.
Hammers, 50 lb., 75 lb., 100 lb., 200 lb. Upright.
Hammer, power, 100 lb. Bradley cushion helve.
Hammers, Nos. 2-B, 3-B, 4B, 6-B, Nazel.
Hammers, steam, forging & drop.
Keyseater, No. 2 Mitts & Merrill, belt drive.
Lathe, 20x12 S-B-E., t. a., q. c. g., b. d.
Lathe, 26"x12' Putnam, q. c. g., d. b. g.
Lathe, 42"x16' Schumacher Boye, q. c. g., belt drive.
Lathe, wheel, 78"x84" Bement, motor drive.
Lathe, spinning 32" belt drive.
Lathe, turret, W&S No 2A & No. 3A s.p.d.
Lathe, turret, 17x6 LeBlond double back gear 18".
Locomotive, gas, 6 ton Milwaukee, 36".
Miller, plain No. 4 Cincinnati, b. d.
Miller, vertical No. 2 Knight, b. d.
Miller, vertical No. 6 Becker, motor drive.
Mixers, Sprout-Waldron, batch & liquid.
Pipe machine, 2", 4", 6", 8" Landis-Oster-Williams.
Planer, 36x36x10' Cincinnati belt drive.
Press, forging, 150 ton United, steam hyd.
Press, wheel 150 ton Caldwell, 42", b. d.
Press, hydraulic 100-ton Southwark.
Presses, OBI, No. 19 Bliss & No. 4 Toledo, 3" str.
Press, No. 55 Toledo, bed 29x19.
Press, double crank No. 5 Bliss, 2" stroke, b. d.
Press, gap, No. 74 Bliss consolidated 6" stroke.
Press, screw, No. 87 Niagara, hand power.
Press, 6 spindle, Waterbury-Farrell.
Press, arch, No. 30 Bliss, roll feed, b.d.
Pumps, centrifugal 6", 4", 1", motor drive.
Punch, EF Cleveland, 36" throat, 1⅛" thru 1".
Punch, multiple, 32E W & W, 10' 2".
Riveters, air, hammer, spinning.
Rolling mill, cold 9"x18" motor drive.
Saws, friction, Nos. 2, 3 & 4 Ryerson motor drive.
Saw, cold, 48" Newton motor drive.
Shapers, 16", 20", 24" & 36" Gould & Eberhardt.
Shears, alligator, 1½", 2", 3", 4" & 6".
Shear, Angle 6x6x1 Long & Allstatter, m. d.
Shear, 60"x3/16" Niagara, 15" gap, b. d.
Shear, 8 x14 ga. Ohl, m. d., 110/220/1/60.
Shear, circle, Niagara, 4" cutters, 16 ga.
Shear, circle No. 3 Bliss, 40"x20 gauge.
Shear, Guill, No. 5 H. & J., 42" rd., m. d.
Shear, guill, No. 2 H. & J., 24" rd., b. d.
Shear, 10'x¼" Bliss, holddown, b. d.
Shear, plate, 80"x¾" Pels.
Shear, plate, No. 6 H. & J., 84"x¾", m. d.
Shear, plate, Covington 84"x1½", m. d.
Shear, rotary 24" throat capacity ½", m. d. 220/3/60.
Slitter, gang, No. 2 W-F, 16", belt drive.
Slitter, gang, 36" Yoder motor drive.
Slitter, gang, 36" Braddock, belt drive.
Slotters, 6" & 24" Newton.
Straightener, 12'x¾" Shuster, b. d.
Straightener, AS & TP 12"x3/16", belt drive.
Straightener, 42" Aetna std. 17 roll 2½" m. d. 220/3/60.
Straightener, 48" Aetna-Standard, 17 roll 3½", m. d.
Straightener, No. 5 K & R., 24" square belt drive.
Thread rollers, W-F No. 7—1½" & No. 20—¾".
Tumbling barrel, 34"x45", belt drive.
Upsetters, 1" to 6".
Welder, spot 13 k. v. a., Taylor.
Welders, arc, 200 & 300 amp. Lincoln.

USED AND REBUILT MACHINERY

WANTED

TAPS — TWIST DRILLS — FILES — CUTTERS
ENDMILLS — SAWS — HACK SAW BLADES

WE WILL BUY YOUR SURPLUS TOOLS

WESTERN TOOL EXCHANGE
18 N. Halsted Street Chicago, Illinois
SURPLUS BOUGHT AND SOLD

CHAIN HOISTS
BOUGHT • SOLD • SERVICED

Your inquiry will be appreciated and given prompt attention.

T. V. LOGEMAN
NORMANDY (St. Louis Co.) MO.
ROsedale 2304 -:- YOrktown 0991

LATHES

We have a few bargains in slightly used lathes, 9" to 16" swing. Write for February Blue List. **South Bend Lathe Works, 325 E. Madison St., South Bend, Ind.**

A Bargain You Find Once In A Lifetime

New drop forged steel VISES, cannot break —heavy duty.

3" Swivel $5.50; 4½" Swivel $7.75; 4½" Stationary $6.75; 5" Swivel $8.50; 5" Stationary $7.50.

These vises were manufactured by the Canal Fulton Drop Forge Company, now out of business. Buy your vises now—before they are all gone.

The Elyria Belting & Machinery Co.
Elyria, Ohio

Immediate Delivery:

6-C Bliss Double Crank Press, tierod construction. Stroke 8".
Diameter of crankshaft 6" & 7".
Area of bolster F. to B. & R. to L. 34"x60".
Die space with stroke down from bed 20".
Motor drive with motor.
Weight 32,000 lbs.
Price on application.

INTERNATIONAL MACHINERY
3131 E. JEFFERSON
DETROIT, MICHIGAN

FOR SALE — GOOD TOOLS

Friction Saw, Ryerson No. 3½ with 75 h. p. motor, 52" diam. blade..... **$2,000.**
Saw, 8"x8" Atkins, m. d..... **$100.**
Shear, Bertsch, 17"xNo. 10 ga., b. d.. **$3,000.**
Automatic Screw Machines, No. 0-G B. & S. high speed, motor-in-base..... **$3,750.**
No. 6 B. & S. auto., b. b. spdl. 2½" cap. **$3,500.**
9/16" Model G Gridley, rebuilt, Timk. roll. bear., new type cross-slide..... **$700.**
⅞" Gridley, Model F, rebuilt, b. b., new type cross-slide..... **$500.**
2⅝" Model F, 4 spindles, ser. 8568..... **$750.**
Cleveland Automatic, 4½", Model A, ser. 25446..... **$1,250.**
Dieing Press, 25 ton, Henry & Wright, with roll feeds..... **$750.**

BANSBACH MACHINERY CORP.
3845 West Madison Street, Chicago

$1000.00

1—60" x 60" x 16' Pond Planer, two heads on rail. Can be inspected in Chicago.

DANIEL M. WHITE
TOOL ROOM EQUIPMENT CO.
565 W. WASHINGTON BLVD.
CHICAGO, ILL. PHONE RAN. 9110

MISCELLANEOUS WANTS

WANTED BY

Capital City Iron Works
3010 Poplar St., - - Richmond, Va.

Power press brake, having a capacity of ¼"x144" steel plate.

LOOKING FOR TOOLS
Consult The
BUYERS GUIDE

All kinds of Vises and Parts Bought, Sold, Repaired and Exchanged

AUTOMATIC screw machines, lathes, drill presses, forges, saw gummers, grinders, blowers, chain hoists, power hack saws, tinner tools, vises, jig saws and lathe tools.

W. A. Strohm
1612 W. Lake St., Chicago, Ill.
Phone Seeley 0574

ELECTRIC MOTORS
New motors at the price of second-hand ones.
Harris Electric Supply Co.
627 W. Washington Blvd., Chicago, Illinois

Due to Manufacturing changes, we offer the following tools, all under belt and ready to run

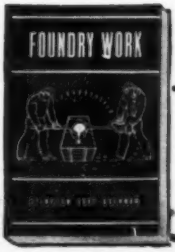
No. 6 B. & S. hand screw—both for bar stock and chucking, with counter shaft—2" capacity,	$300.
Hendey Lincoln Type Miller and c. s.	150.
Landis 6x12 Cylindrical Grinder and c. s.	250.
Cochrane-Bly cold cut-off saw with brand new 22" circular saw,	100.
2¼ Gridley Model F—rebuilt by Modern Tool and Die and never run since,	900.
5 spindle Avey drill, No. 2 Morse taper, motor driven, with belts and 5 Jacobs chucks	300.
3 spindle Henry & Wright high speed No. 2 Morse taper, motor driven, with belts and has 3 Jacobs chucks,	200.

INDIANAPOLIS SCREW PRODUCTS CORPORATION
621 NORTH NOBLE STREET INDIANAPOLIS, IND.

For Your Library

Two Books Of Labor and Time-Saving Shop "Kinks"

FORGING PRACTICE — Johnson — 136 pages—Gives the properties of the various workable metals in clear, concise, and non-technical manner. Explains ALL types of forging, welding by forging and tool forging, hammer and hand forging, etc. Many other interesting chapters loaded with information. Price $1.50.



FOUNDRY WORK—Stimson and Gray—revised by John Grennan. Its 216 pages are filled with useful information concerning die casting, molding practice, equipment and processes, melting equipment, fuels. No process in the making of castings has been overlooked. Price $2.00.

Send For Your Copies TODAY

HITCHCOCK PUBLISHING CO.
BOOK DEPT.
508 S. DEARBORN ST.
CHICAGO

IN STOCK — IMMEDIATE SHIPMENT

ANGLE IRON SHEARS
Covington, 6x6x¾", double end
No. 2 H. & J. 6x6x½ on turntable
Pels Angle & Beam Shear, 8x8x¾

AUTOMATIC SCREW MACHINES
No. 00G B. & S., Ser. No. 8300
No. 00 B. & S., Ser. No. 9800
Auto. No. 52, 1¾" Gridley 4 spdl.
2¾" Cleveland Model A, sq. pan.
Nos. 1, 2 and 3 Manville Auto

BORING MILLS
12" Niles Cyl. Boring Mach. D. S.
88" Niles Vert., 2 heads, M.D.
42" N.B.B. a.p.d.; 42" Gisholt Vt.
52" Bullard, 2 heads on rail
P & H. Horz. Boring Bar, 7" quill, 4½" bar

BRAKES: Hand
Chicago Steel 10'14 ga.; 3'16 ga.; 4'-12 ga.; 8' 18 ga.; 8'-16 ga.; 8'-14ga.; 10'-16 ga.

BRAKES: Box & Pan
4', 5', 6' and 8' 14 ga. Ch. St.
6'10ga. 4'10 ga. Chgo. steel—Pr.

BRAKES: POWER
8'¼", 10'3/8", 12'¼" Chgo. Steel, Power Clamping; 8'10ga.; 8'12 ga.; 6'10 ga.; 6'12 ga.; 3'3/16"

CAN MACHINERY
No. 201 V & O aut. Thread Roller
Double Seamers, No. 3 Bliss; No. 125 Adriance; No. 108 Cameron, semi-auto.

DRILL PRESSES
17" Canedy-Otto, vertical, M.D.
Leland Gifford, 1 to 4 spdl.
6 sp. Edlund, P. F. No. 2B Ed-
No. 2 Bausch Mul., 22 sp.
No. 11 Natco Multi. No. 14 Natco
Allen High Speed, 1, 2 and 3 sp.
5 spindle Detroit Horiz. Auto.
No. 3 Avey High Spd., R.B., M.D.

GANG SLITTERS
32" Am. Can (10); 36" L. & N.
36" Cameron; 48" Bliss

GRINDERS
16x66 Landis, No. 12 B.&S.
6"x20" Fitchb., cylindrical.
84" diam. face, m.d.
No. 1½ Cinc. Tool & Cutter
No. 4 Gallmeyer & L., M.D.
SURFACE B. B. Foundry Grinders, 22"x5".
No. 2 B.&S.; N. 3 Abras.; 8" Arter rot.
No. 3 Diam.; 12x48 m.d.

HAMMERS
100-lb. Mayer Trip; No.7 Beaudry
No. 2B Nazel; Stand. Auto. drop, 200 to 400 lbs.

LATHES
Hardinge, Precision, 1" cap.
36"x20" New Haven; 30"x16' L. & S. Q. T. A.
9"x3½"; 16"x8' P. &W., Q. C. G.
18"x10' L.&S. g.b., m.d.
24"x12' Reed P., Grd. Hd. T.A.

LATHES (Cont.)
36"x30' L&S 24' cent., qcg; 48"-18' Schu. & B.
24'48 McCabe Dbl. Spindle
14"x6'; 16"x6'; 18"x8' Monarch; 14"x6' Bradford.
30' Pit Lathe, dia. face plate 156"
64"x25' Bement Engine
38"x20' Harrington.
Sundstrand 8" Stub Lathe.

LATHES: Spinning
Pryibil 22" B. B. (7); 24", 28"

LATHES: Turret
No. 4 & No. 6 W. & S., cone; No. 3 Foster, g.b.
No. 9 Bardons & O., No. 8 Foster
Foster, 1¼" cap.; 21" Gisholt

PLANERS
26"x 8' Cleve. Opensi., 24x8 Cl.
36x12 Openside Dietrich & H.
20' Niles Plate Planer

EXCEPTIONAL TOOLS

GRINDERS
No. 2 Cin. Centerless
14" P & W, vert., Model B
No. 16 Blanch., sur., 36" ch.
No. 25 Landis Cyl. 24"x144"

LATHES: Turret
No. 3L Gisholt, hardened ways, m.d.

LATHES
16"x8' P&W, qd. hd., fully equip.
18"x10' L&S, qd. hd., m.d.
30' Pit Lathe, 156" face plate

JIG BORER
No. 2 Pratt & Whitney, M.D.

MILLERS: Vert.
No. 4 Cincinnati

PRESS BRAKE
10'x3/16" Chicago Steel

RADIAL DRILL
5' Carlton, motor drive

MILLERS
No. 21 B.&S. Plain.
48" Cinc. Auto., No. 25 Ohio U.
No. 2A K. & Tr. V.H.—No. 1A
No. 1Y B.&S. Horiz.; No. 3 B.&S.
No. 2, 3, 4B, 5B Becker Vert.
Model C Becker Vert.
No. 2 Pratt & W. Die Sinker
Thread Mill, 6x48, P. & W., m.d.
36"x168" Ingersoll, planer type
Ingersoll Planer Type Mill, Mch., 40 H.P. mtr. 48" x 22' 4 hds.

NIBBLERS & UNISHEARS
No. 1, No. 1B, No. 2 Cambell
No. A14, A-10, Uninshear
No. 0 Gray Nibbler, 1/8" cap.

RADIAL DRILLS
5' Carlton M.D.; 6' Am.; 5' Fos
6' Western; 6' U.; 3' hvy. type
Reed - P.; 4' Hammond
knife, M.D.

RIVETERS: Stake & Punch
New Doty, 52" throat; Rock Riv
56" throat
No. 2A, 3A, 5A & 5½ B Hi
Speed Riveting Hammers

ROLLS: Bending
8' ¼" Beloit; 8' 10 ga. Bertsc
48"x3/8"; 36"x3"; 6' Beloit.
8'x1" Niles Pyr. drop end.

Rolls, Angle Bending, 4x4x½, M.D.

ROLLER DIE MACHINES
7-Spindle, Adjustable, M.D.

LEVELLERS ROLLER
48" 17 rolls, M.D.; 38" Hilles&
54" McKay 17 Rolls, M.D.

PUNCHES
No. G 15 Rock River; No.
Whiting, 24" th.
No. 000 H. & J. Dble. End Pun

SAWS
No. 0, 1 & 2 Ryerson Fri
Hack Saws; 13x16" Peerless;
6", 9x9" Peerless Shaping.
No. 8 Marvel

Hydraulic Scrap Baler 150 lb. bales, Galland & Hen ning. 56" x 16½" x 24'

SHAPERS AND SLOTTERS
20" Queen City; 16", 24",
and 32" G. & E.; 20" G. &
24" American SPD thru gear
24" Bement Slotter

SHEARS: Power and Foo
6'¼" Chgo. Steel, 24" gap;
10'18ga. Nia.; 6'10ga. Rob.
Bertsch 10'3/16; 13' ¼" Unit
10'3/16" Chgo. Steel, M.D.;
10' 10ga. Rob.; 10' ¼ Nia. 18"g
10'¼" Nia. 18" gap; 10'
United Eng..
5' ¼" Toledo.
12' 14 ga. Streine; 12' 10
42", 18 ga. Niagara
No. 1½ D & K Milw. Allig
Rotary Quickw., 60" thr., 14
Quickwork No. 25, cap. 7/32"
Throatless 10 ga. ¼" &¼"
Foot Shears, 20", 30" 36", 9
Circle Shears, No. 19 Nia.

WELDERS: Spot
5, 7½, 10, 25 KW.
100 KW Federal. Projection W
Butt welders, 30 KW; 65 K

WELDERS: Arc
400 amp. Wil.; 300 amp. Han
400 and 600 amp. P.&H., gas

INTERSTATE Machinery Co., Inc.
OFFICE AND SHOW ROOM, 109 SO. CLINTON ST., CHICAGO, ILLINOIS

IN STOCK — IMMEDIATE SHIPMENT

PRESSES: Double Crank

94G Toledo, 36x84" bed, 8" str.
No. 96-G Toledo, 146" betw. upr., 24" str., tie-rod, wt. 162,000 lbs.
No. 17 Bliss, Gap Fr.; 8" str.
No. 7-F Bliss, 96" betw. upr.
Multiple Gang Punches: No. 6 Nia. 36" bet.; No. 35 W. & W. 8' bet hou.; No. 30A W.&W. 10' bet. hou.; No. 32 W.&W. gang 54" bet. hou.
No. 138A Stoll, 38" bet. uprights
No. 1D Bliss Dbl. cr., 4" str.

PRESSES: Horn

No. 14 Toledo; No. 116A Nia.
No. 21 Bliss; No. 42 Toledo.
No. 43P Toledo, 18" thr.; No. 39 Bliss.
No. 24 Bliss Cona. B. G., 6" str.

PRESSES Deep Throat

Toledo No. 17, 20" thr.; No. 15

PRESSES: Straight Side

No. 66 Cons. 8" stroke
No. 57 Toledo, 8" str.
No. 6 Walsh, b.g., 3½" str.
No. 74W Bliss Wedge type
No. 832 Verson All Steel 250 ton, 12" str., Marquette air cushion, bed 54x32.

PRESSES: Toggle

No. 3½-B Bliss; 3½ & 3¼A
No. 408-B Bliss, 84" bet. upr., 50 x 84 bed
No. 409 Bliss, 108" bet upr.

PRESSES: Coining

No. 664 Toledo, 600 ton. No. 27K Bliss 1000 ton—2¼" st.
600 ton Waterbury Farrel

PRESSES: Hydraulic

Woods, 150 ton, 49" bet. hslgs.
No. 2727 Elmes, 325 Ton.
200 ton Watson-S., 2-10" rams, 38"x62" bet. cols.
350 ton Southwark, 30" dia. ram, 42"x54" bet. cols.
1000 ton Birdsboro, triple ram platens 10" x 12'

PRESSES: Stiles or Solid Back

Ferracute, P2, P3, P4.
No. 4 Bliss, No. 83 Bliss
No. 4N, 5N Bliss; 34 P Tol. No. 36 Bliss.

PRESS BRAKES

Verson All Steel, 60"x14 ga. cap.

PRESSES: OBI

No. 5 Toledo (3); No. 5 Cons.
No. 20 Bliss; No. 40 Perkin
Wire Straightners: 3/8"x8'; N
6 Wells 3/8"x22'.
No. 2X Garvin Tapper
No. 4 Nia.; No. 3 Toledo; No.
Bliss Horizontal, 8" str.
No. 3 Niagara (5); No. 2 Rockf
No. 62 Bliss Reducing 8" Strok
No. 4 L & J; No. 75B Toledo

MISCELLANEOUS

Air Compressor Ingersoll Rand
10x10; 14x12.
Buffer: No. 3-D Gardner, 5H
Column facer, 48" Newton, M.T
Filing Mch., No. 3 Thiel, M.D. (2
Folders, bar, 20"30"36"42".
Furnace, Elec., large Pusher typ
Gear Hobber, No. 16 H.S. G&E
Groovers, pow., 8', 36", 48" Nia
Davis Gas Acetyl. Gen., 300-lb. (2
Keyseaters, Nos. 2, 3, Mitts &M
54" Sheridan Paper Cutter, Powe
No. 8 Mott sand blasting outf
No. 4, 8 Gaterman Pneu. Tappe
Oil Separator and Chip Crushe
Pipe Threaders, 2" to 10"
Tumbling Barrels, 32"x44"

INTERSTATE MACHINERY CO., INC.

109 SO. CLINTON ST., CHICAGO, ILL.

"READY TO SHIP"

NORTON Open Side Surface Grinder, 6'x10'x36', Motor Driven.
NORTON 3'x18' Plain Cylindrical Grinder, 10'x50' countershaft.
CINCINNATI No. 2 Universal and Plain Millers, countershaft.
WARNER & SWASEY No. 1-A Turret Lathes, chucking equipment, Single Pulley Drive. Serials 250,000.
WARNER & SWASEY No. 4, No. 2 and No. 1 Turret Lathes, Wire Feed, Cone Drive.
FITCHBURG Low Swing Lathes, geared head, S. P. D., 5'x5' centers.
LODGE & SHIPLEY 24'x16' Screw Cutting Lathe, 12 speed geared Head, Single Pulley or motor drive. Serial 26,000.
PRATT & WHITNEY No. 13 Multiple Spindle Drill Press, rectangular head.
NATCO No. 14 Multiple Spindle Drill, 22 spindles, R. A. Head, 18'x26' Table 22'x30', S. P. Drive. Serial 11,200.
ALLEN High Speed Sensitive Drills 2, 3, and 4 Spindle.
BROWN & SHARPE No. 2 Hand Screw Machines, Power Feed to Turret, c./s. drive.
GOULD & EBERHARDT Crank Shapers, Cone Drive 24'—16'—14'.
CLEVELAND 2¾' Automatic Model A.
GRIDLEY 1¾' 4 Spindle Automatic Model F, countershaft drive.
BROWN & SHARPE No. 0 Automatic Screw Machine, countershaft drive.
LOY & NAWRATH 10 ft. Power Squaring Shear, 3/16 capacity, m. d.
DREIS & KRUMP 6 ft. Box and Pan Brake, Motor Drive, 10 gage.
NIAGARA 7-B Geared Inclinable Power Press, 5' stroke.

Other just as desirable tools in our large stock. Send for catalog.

MORRIS MACHINERY COMPANY, INC.

97 Chestnut Street - - - - - Newark, N. J.

3000 MACHINES IN OUR WAREHOUSES

BORING MILLS

Bullard 12"—8 Sp. Multaumatic
Bullard 24" New Era, M.D.
Niles 42" Two Head.
B., 36", 42", 2 hds. on rail.
Bullard 76" vertical.
Giddings & Lewis No. 32 hor.
Rockford No. 2, 2" bar.
Barrett No. 2 cyl., 5" bar.
Rochester No. 41 M.D. Floor Type, 4" Bar, Horiz.

DRILLS

P. & W. No. 1 Gun Barrel.
P. & W. Nos. 11, 12, 13 Mult.
Fosdick 4' Radial, M.D.
N-B-P 6' Radial, Univ.; Reed-Prentice 6' Radial.
Upright Drills—All mak. & siz.
Allen 3, 4, & 6 sp. B.B.
Detroit No. 2, 5 Spdl. Hor.

GRINDERS

Blanchard No. 16.
B. & S. Nos. 1, 2, 3, Univ.
Bryant Nos. 6, 10A, 18A, S-A, 2 Sp. Hole, No. 40 Chuck.
Disc Grind.—All makes & siz.
Heald No. 72A3 Gagematic Internal, M.D.
Norton 10"x18" M.D. Plunge Cut.
Nort., 6x32", 10x36", 10x50", 10"x72"; 14"x72" Pl. Cyl.

LATHES

Hendey Lathes—most sizes.
Monarch 16"x10' G. H., B.B.
American 20"x8', g.b.
New Haven 24"x10', 24"x12', 24"x20'.
Pittsburgh 32"x24', q.c.g.
American 36"x17' G.H.
W.&S. Nos. 1A, 2A, 3A Tur.
W-F No. 3 Chucking.

MILLERS

Kempsmith No. 3 Universal.
Milwaukee No. 1JB Double Over-arm Universal.
Hendey Nos. 2G, 3G Univ.
Cincinnati No. 1M Univ. 8PD.
Cinc. No. 3S Pl., 8PD, PRT.
Van Norman No's. 1, 2, 3, Dupl.
Lincoln Millers of all kinds.
P. & W. 6x14"; 6x48", 6x80" Thread millers.
Milw. & Garvin Cam Millers.

PRESSES

Bliss No. 18, 19 & 20 O.B.I.
V. & O. No. 12, 14 D.A.C. In.
Zeh & Hah. 8¼C Percus.
Bliss No. 21, 100 ton K. J.
W-F 200 ton Knuckle Joint
Wat.-F. No. 6 D.A. Pillar Cam.
Ferracute No. 105 D.A.
Ferr. D.G. 53 S.S. Draw.
Terkelsen D-1 150 t. M. Spring.
Stand. No. 4-R S.S. Reducing.
W-F Long Stroke for shells.
W-F No. 3 Blanking.
Ferracute No. PG-P4.
Henry & Wright 25 & 50 ton Dieing Machines.
Bliss No. 16, 4" str., Overh.

SCREW MACHINES

Grid. 9/16", ⅞", 1¼" Mod. G.
Clev. ⅜", ½", ⅝", ¾", ⅞", 2", 2¼", 2¾", 4¼" Auto.
B.&S. Auto.—most sizes (we are specialists).
New Brit. 1x5", 1¾x7" A.
Cone 1¼" Automatic.
Hand Screw M. of all makes & sizes; W. & S., Foster, B.&S.
Potter & Johnston Nos. 5A, 6A Chuckers.

MISCELLANEOUS

Broaches, LaPointe 1-2-3-4.
Burnishing Barrels, Abbott.
Goss & DeLeeuw Quadradial Chuckers.
Hammers-Board Drop, must be moved.
Headers, many sizes & makes.
Lapper-Norton 15C.
Measuring Machines, P.&W. 12", 24" & 48".
Rolling Mill, Robertson 12"x12" for non-ferrous metal.
Shapers—from 7" to 32".
Slitter, Braddock 36" M.D.
Tapper—Threadnut No. 2 auto. nut.
Wire Formers, Nilson&Baird.

BOTWINIK BROTHERS, INC.

37-127 WATER ST. :•: **NEW HAVEN, CONN.**

IF WHAT YOU WANT ISN'T HERE *Send Us Your Inquiry*

BRAKES:
No. 183 Chicago 8 ft. 12-ga.
No. 614 Chicago 6 ft. 14-ga.
No. 618 Chicago 6 ft. 18-ga.
Chicago Press Brake, 8'x3/16".

DRILLS:
Radial, 3 ft. Foodick.
Natco Type K 20-spdl.
Rail. Foote-Burt Nos. 2 & 4, 4 spdl.
Prentice, 4-spindle.
Allen BB 5-spindle.
Allen BB Type B sgl. spdl.
Demco DAH BB, MD.
36" Cincinnati BG PF SL.
25" Bickford, G. & E.; Sid. Hd., P. F.
20" & 24" Prentice BG.

GRINDERS:
Disc, No. 6—20 Besly.
Disc, No. 220 Badger & press.
Disc, No. 41; Besly 20".
Drill, New Yankee, D. E.
Internal, Madison: No. 65 Heald.
Surface, No. 210 Heald 8".

HAMMERS:
50-lb. Little Giant MD.
40-lb. Bradley Helve.

LATHES:
26"x12' Putnam Pacific type, DBG, Semi-QCG, T. A. 26" Chuck.
18"x8½' Rahn & Mayer.
18"x8' Lodge & Shipley MD.
14"x6' Lodge & Shipley.

LATHES—Turret:
16" Type A Gisholt, 6¼" hole.
21" Type H, Gisholt, 3⅝" hole.
24" Type I Gisholt, 4⅜" hole.
24" Type I Gisholt, 4⅜" hole.

MILLERS:
No. 1-B Kearney & Trecker Plain.
No. 2 LeBlond, plain, M. D.
Nos. 2 & 3 Kempsmith, plain.
No. 25 Becker-Brainard.
No. 3B Owen, DH, Vert. att.
Pratt & Whitney, 2" spline.

PRESSES:
Hydraulic, 42-ton Elmes.
OBI. No. 0, 4½ Loshbough-Jordan.
Str. Side, No. 7 Z & H, geared.
Str. Side D-44 Pexto OBI No. 29 Swaine.

PUNCHES & SHEARS:
Queen City DE. ½ in ½". M. D.
Rock River L. ½ in ½": 24 thr.
Cleveland C. SE. ¾ in ¾", 26" thr.
No. L-10 Badger. DE. ½ in ½".
No. 14½ W.-W., 25" thrt.; m. d.
No. 54 Beloit S. E., ¾" in ¾".

SHEARS:
Jig, GEM, 18 ga. cap., M.D.
Rotary Bevel, Lennox ¾".
Square, Stark 9'; 18 ga. cap.

THREADERS, Pipe & Bolt:
Murchey, ¾" dbl. head, bolt.
Pipe, 2" Oster M. D.

MISCELLANEOUS:
Bender, No. 15 Wallace.
Dbl. Seamers, Swain.
Compressor, H-B CCB, 14x9x8, 20 HP motor.
Groover, 30" Toledo.
Planer, 30"x30"x8' Pease and Wheeler.
Metal Band Saw, 14" Racine.
Rolls, 10' Pyramid, ½" cap.
Saw, cold, No. 2-B Cochr.-Bly.
Shaper, 20" Smith & Mills.

Brown Mchy. Co., 2333 N. Ninth St., St. Louis, Mo.

WRITE FOR LATEST STOCK LIST No. 170.

Many Tools Rebuilt for Immediate Delivery.

10"x5' Pratt & Whitney cone drive lathe.

13"x6' Sebastian cone drive lathe.

15"x6' South Bend cone drive lathe.

16"x6' Hendey geared head lathe.

16"x6' Pratt & Whitney geared head lathe.

16"x10' LeBlond, t. a. relieving att. lathe.

No. 2A Milwaukee double o/a mill.

No. 3 Cincinnati Miller.

No. 3 Brown & Sharpe miller.

Nos. 2A, 3A, 4A & 7B riveters.

24" Gould & Eberhardt Shaper.

24" Potter & Johnson, universal shaper.

25" Cincinnati.

MILES MACHINERY CO

SAGINAW, MICHIGAN

ATTENTION: — SHEET METAL WORKERS

We are now liquidating large plant that formerly manufactured various lines of household utensils, tubs, etc.

The following is a partial list of main items. Offered subject to prior sale and inspection. F.O.B. St. Louis. May be inspected by calling at our office for permission and escort through plant

No. 3¾B Bliss toggle drawing press tie rod.
No. 5 Bliss toggle drawing press.
No. 4 Bliss toggle drawing press.
No. 3½A Bliss toggle drawing press.
No. 7 Bliss Consolidated OBI press
Nos. 18—19—19C—20 & 21 Bliss OBI presses.
Nos. 16—39 Bliss horning press with & without tables.
Swaine & Consolidated horning presses.
Double seamers Bliss various sizes.
Double seamers 3 Adriance.
Foot power Kick presses, all sizes.
No. 242 Niagara power sq. shear.
10 foot power sq. shears.
Cameron auto. can machine.
Spot Welders foot power 10 to 20 KW.
C2 Becker vertical miller, very good.
3' Arm American radial drill enclosed head
18"x6' American Q.C.G. lathe cone drive, good.
Bar folders, small forming rolls, bench, hand power crimpers, beaders, circle shear, etc.
6—Bliss spinning lathes belt drive various sizes.
3—strap drop hammers.
2 heat treating furnaces blowers & pyrometer.

In other plants we have six vertical press brakes, and miscellaneous other sheet metal machinery available.

Also large stock of machine tools, air compressors, electric motors, and varied equipment.

Wm. C. Johnson & Sons Machinery Company, 1211 HADLEY ST., ST. LOUIS, MO.

AS LIQUIDATORS WE OFFER:

1—No. 35 Rochester F.T. Boring Mill, with duplicating attachment.
1—42"x12' Liberty Open Side Planer.
1—36"x36"x18' Gray Planer, 2 heads.
5—Wicks Crankshaft Lathes.
7—6A Potter & Johnson Lathes.
5—Potter & Johnson Unimatic Lathes.
1—24" American S. P. D. Shaper.
1—No. 3 LeBlond Plain Milling Machine.
1—27" will swing 30"x12' LeBlond all geared head Engine Lathe.
1—No. 4 W. & S. Univ. G. H. Tur. Lathe.
4—No. 11 G. & L. Terom. Int. Grinders, m.d.
3—No. 12 G. & L. Terom. Int. Grinders, m.d.
1—No. 11 B. & S. Motor Drive Grinder.
5—No. 12 Browne & Sharpe Pl. Grinders.
2—No. 1 P. & W. 2-sp. deep-hole Driller, motor drive.
1—No. 18H Gould & E. Gear Hobber.
1—Gould & E. No. 36 S T Gear Rougher.
2—No. 3 Barber-Colman Gear Hobbers.
1—Natco No. C-13-H Hyd. Multiple Drill.
1—No. 14 Natco Mult. Drill; 12—1¾ O. D. spindle.
3—No. 310 Baker Drills.
1—No. 416 Baker Drill.
1—84" Diamond Face Grind., arr. for M. D.
1—11'x14 Ga. O. D. Power Square Shear.
1—3¾" National Acme 4-spindle Automatic.
2—⅞" Model "G" Gridley Automatics.
5—Cleveland Automatics.
1—3" Model "B" Nat'l Acme 4-sp. Auto.
1—Ing. Rand Imp. type No. 10 Air Comp., Size 16x10x14 with 100 H. P. motor, cap. 750 c. f.
1—1½" Acme Steel Bed Upset., arr. for M.D.
1—3" Acme Steel Bed Upset., arr. for M.D.
1—Model "IB" Cleveland S. E. Punch, 36" Throat.

THESE ARE BUT A FEW OF THE MANY ITEMS WE HAVE TO OFFER

RIVERSIDE MACHINERY DEPOT
285 St. Aubin Avenue, - - - - Detroit, Mich.

BRAND NEW LATHE CHUCKS—STEEL ALLOY

LAFAYETTE (MADE IN U. S. A.) UNIVERSAL GEARED SCROLL LATHE CHUCKS HEAVY DUTY, ACCURATE AND GUARANTEED AS TO QUALITY.

—TWO SETS OF JAWS—

Size	*List Price*	*OUR PRICE*
4"	$50.00	$16.50
6"	62.00	22.50
8"	72.00	26.00
10"	96.00	33.50

Send for our list of independent combination and universal chucks from 5" to 36".

DE WITT TOOL COMPANY, 173 Grand St., NEW YORK CITY

Guaranteed

DRILLS

6' American Triple Purpose Maxi-Sp. 17" Col. Tap. Att. A. C. motor mounted on arm. Extra right angle base.
No. 121 Baker, 1½" Cap. M. D.
No. 13 Natco, 16 Spindles.
No. C-5 Natco, 10 spindles.
28" Cin-Bick. Tap. Att., Gr. Box.
20" Barnes all-grd. self-oiling.
1 & 2Sp. Demco, H.S B.B.
1, 2 & 3 Sp. Allen, P. F. & T. A.
4 spindle L-G No. 2 M. T. p. f.
4 spindle Avey, B. B. 2 M. T.
3½' Morris rad. A. C. Mtr. Dr.
5' Dreses Univ. rad., arr. m. d.

GRINDERS

No. 6 G. & L. Hyd. Sur. 12"x48" Cap. A. C., M. D.
No. 2 Heim Centerless, M. D.
5 H. P., 18" Queen City Disc, b. b., New.
No. 1 Cincinnati tool & cutter.
No. 2 Norton cutter & reamer.
No. 1 Wil & M. B.B Hand Surf.
No. 2 Brown & S surface, b d.
No. 2 Gardner disc 18", disc pr.
No. 7½ Gardner, 30" Disc, B.B.
No. 20 Heald rotary surface.
No. 11 B. & S. Plain, S. P. D.

LATHES

30"x16' H S. & Gamble, q. c. g.
24"x12' Schum. B. q. c. g.
20"x 3' Cisco Grd. Hd., M. D.
20"x9' Hamilton, q. c. g.
18"x8' B. & E., q. c. g., t. a.
16"x6' South B., q. c. g.
16"x6' C. & J., grd. hd., Timken Bearing, motor in base, new.
14"x8' Hendey, cks. & collets.
14"x6' Hendey, Q. C. G.
9"x12" Sundstrand Mfg. grd. hd.
½ & ¾" Hardge. Bench, Collets.

LATHES (TURRET)

54" Bullard New Era Vertical, Side Head, 4 Jaw Chuck Table. A. C., M. D.
No. 5 Foster All Grd. Hd. S.P.D.
No. 4, Warner & Swasey 6 spd. Geared Head, M. I. B.
No. 4, W. & S. cone hd., col.
No. 2A W. & S. univ. 3¼" Hole, single pulley drive.

MILLING MACHINES

No. 1 Kent Owens B. B. Hand.
No. 1 B. & S. Plain, cone head.
No. 2, Van Norman Sub Head.
No. 2Y, B. & S. Pl., mtr. drive.
No. 6 Whitney hand, motor dr.
No. 3 Rock'd Rigidmill, M. D.
No. 2½ Rockford universal.
No. 4B Becker, vert.
No 2 B. & S. Plain, B. G.
No. 2 Kemps, Universal, B. G.
No. 3 Kemps, Pl. & Univ. B. G.
No. 4 Hendey Norton Pl. S.P.D.

PRESSES

No. 27K, Bliss, 1000 ton Knuckle Joint Emb. & Coin. 2½" Str. Arr. M. D. less Mtr.
30 Ton Lucas Forcing, M. D.
Model "B" Rockford obi Bench.
No. 2R & 3R Rockford. obi new.
No 62 Bliss S. S.
No. 6 Fox "Superflex".
No. 1 Bliss Cam, Fly & Grd.
No. 4 Rock. & Walsh, o.b.i, Grd.
No. 5 Bliss-Con. o b. i.; Grd.
No. 6-C Bliss Dbl. Crk., Grd. M.D.

SCREW MACHINES

No. 0 B & S Hand m. d.
No. 00G B. & S. Auto. M. D.

SHAPERS

16" G. & E. Gear Box, M. D.
16" G. & E. b. g. crank.
16" & 20" Steptoe b. g. crank.
20" G & E. & Milw. b. g. crk.
20" Hendey B. G. Crk. S. P. D.
24" Stock. & Milw. b. g. crank.

MISCELLANEOUS

Bolt Cut., 2½" Landis 1 ead Scr.
Broach, No. 2 LaPointe S. P. D.
Broach, No. 3 Oilgear.
Comp. 7x6 Worth Dup., M. D.
Die Filer, No. 5 Rearwin, m.d., New.
Die Filer, No. 5 Thiel, m. d.
Gear Hobber, No. ½ S & S.
Gear Hobber, No. 3 B-C, M. D.
Ironworker, No. 27x30U Buffalo Universal, 30" Throat, Cap. 1" Plate.
Marking Mch. No. 12 Martin.
Nibbler, No. 2 Campbell, M. D.
Planer, 30x30x10' Am. Box Tbl.
Planer, 30"x24"x8' Gray.
Planer, 72x54x24 Pond Dble. Hang, 2 hds. cross rail, 2 side hds. M. D.
Punch & Shr., No. 55 H. & W.
Riv. Ham. No. 2 Grant, ¼" Cap.
Riv. Hmrs. Nos. 1 AA, 2A, 3A, 3A H. D., & 5A High Speed.
Riv. Spin. ¾" Linley, M. D.
Saw, No. 2 Klemm Metal Band, M. D.
Saw, 6x6" Peer, univ. shpg. m.d.
Scleroscopes, 'D' Shore.
Shr., 6'x14 ga. D. & K., sq., m.d.
Shear, 10' x 14 ga. D. & K. Square, Motor Drive.
Shear, No. 130 Marshalltown
Rotary, Serpentine, M. D.
Slotter, 3½" Garvin Die.
Slotter, 10" Sellers.
Slotter, 3½" Rhodes Vertical.
Tester, No. 3H Rock. Hardness.
Welder, 10 kva Amer. Elec. Fus.
Welder, 12½ K. W. Fed. Spot.
Welder, No. 20A Thomp. Butt.

George M. Bernstein & Co.

12 SO. CLINTON STREET CHICAGO, ILLINOIS

YOURS FOR BETTER TOOLS—

MILLING MACHINES

No. 2A B. & S. Universal, Motor Drive.
No. 2B B. & S. Plain, "tapr'd nose" M. D.
No. 3B B. & S. Plain, M. D., No. 4 Table.
No. 2 Cincinnati, S. P. D., High Power.

HENDEY LATHES

20"x8' Geared Head, M. D., Taper Attachment.
18"x8' Geared Hd., M. D., Taper Attachment.
16"x6' Motorized, Taper Attachment.
12"x5' Grd. Hd., M. D., Taper Attachment.

SCREW MACHINES AND AUTOMATICS

3A Warner & Swasey, Motor Drive, Bar Feed.
1A Warner & Swasey, Motor in Base, Bar Feed.
No. 4 Warner & Swasey, Bar Feed.
Nos. 3, 2 and 1 Foster.
Nos. 0, 1 and 2 B. & S. Screw Machine.
No. OG B. & S. Automatic, Motor Drive.

DRILL PRESSES

1 to 6 Spindle Allen, Avey and Leland Gifford, Belt and Motor Drive.

GRINDERS

No. 5 Abrasive Surface, Motor in Base.
No. 3 Abrasive Surface, Motor in Base.
14" P. & W. Vertical Surf. M. D. Model "B".
No. 10 B. & S. Plain Cyl, Self-Contained.
10"x24" Landis Plain Cylindrical.
10"x36" Landis Plain Cylindrical.
No. 2 Norton Universal Tool & Cutter, M. D.

RADIAL DRILLS

3' Cincinnati Bickford Super Service Motor on the Arm—Universal Table.
3½' American Triple Purpose, S. P. D.
3½' Dreses Radial, Single Pulley Drive.

SHAPERS

24" Milwaukee, Back Geared.
24" American, Back Geared.
20" Steptoe, Back Geared.
20" Rockford, Single Pulley Drive.
16" G. & E., Motor Drive, Back Geared.
16" Smith & Mills, Back Geared.

CLINTON MACHINERY CO., 32 So. Clinton St.,
CHICAGO, ILLINOIS Tel. Central 3019

Modern Machinery for Sale

1—No. 3 Ryerson-Conradson Universal Milling Machine single pulley drive, with universal dividing head, and vertical milling attachment.

1—No. 33 Kempsmith Production Milling Machine, Single Pulley Drive.

1—Lucas Horizontal Boring Mill, single pulley drive through gear box. Spindle dia. 2⅝". Max. distance spindle to outer support 60".

1—24" Bullard "New Era" Vertical Turret Lathe. Single pulley drive through gear box, with turret head and side head, with threading attachment.

2—38—44" Niles-Bement-Pond vertical turret lathes single pulley drive through gear box with turret on cross rail and side head. Very modern design.

2—No. 6 Fellows Gear Shapers for external and internal spur gears.

2—No. 0 Brown & Sharpe Automatic Screw Machines. Hole through largest feeding finger ½".

1—No. 2 Cincinnati Centerless Grinding Machine arranged for motor drive. Capacity 3" dia. and 9½" long.

1—No. 3 Brown & Sharpe Universal Grinder with internal grinding attach.

Laurens Bros., Peoples Bank Bldg., Cincinnati, Ohio
Parkway 3315

Good Used Machinery

ARC WELDER—Wilson 300 amp., 15 h.p. motor; portable; UNA 300 amp., 10 h.p.

BORING MILLS—Niles 36" c. d. Baush 44" m. d. N-B-P 54" s. p. d. Vert. with 2 heads; Bullard 51" Vert., 2 hds.; Rock. No. 2 horiz. 3⅛" Bar; Colburn 42" vert.

BRAKES—D. & K., 5' Box & Pan, 14 ga. D. & K. 10' 10 ga. Leaf type Power & Keene 10' 16 ga. Toggle Press.

DRILLS (RADIAL)—Mueller 2½', Fosdick 2½', Prent. 3'; Carlton 4' all gear box dr.; Hammond 4' sensitive; Amer. 2½" M.D. gear box. Mueller 4½' g.box.

DRILLS (H. S. B. B.)—H & W 2, 4, 5sp.; Allen 2 & 6-sp.; Avey, Demco, Lel-Giff. 1-sp.; Avey 2-sp.; Aveymatic 2-sp., m.d.

DRILLS (MISC.)—Baker No. 217 (2) & No. 314 Hvy. Duty; Hamilton 42" S.H.; Barnes 20" & 24" 1-sp. & 20" 4-sp. & 24" 3-sp. all grd. camel back; P & W No. 12 Multi-Sp.; Natco 20-sp. Rect. head.

GEAR CUTTERS—G & E 60" & B & S 26" s. p. d. automatic spur; Fellows 24" gear shaper. Cincinnati 36" gear cutter.

GRINDERS—P & W 12" vert. surf.; Cin. No. 1½ & B & S No. 12 univ. tool, B &S Nos. 11&16 pl.Heald Nos.60&65 Int.; Landis 10x30" Plain; B & S 10x48"; 3—Norton 6x32" plain, Heald No. 20 Rotary Surface (3). B & S No. 2 Univ.; Badger No. 220, auto. d. e., opposed disc (4); Walker 6" Rot. Surf.; Modern No. 6 Int. Brown & Sharpe No. 2 Surf.; B.&S. No. 10 pl. self- cont. Norton 10"x36".

KEYSEATERS—Mitts & Merrill No. 5 vert. Davis No. 1; M.&M. No. 0; Catlin No. 2.

LATHES—Monarch 16"x10' M.D.; LeBlond 18x8'; Lehmann 18"x9'; Amer. 22x8'; Davis 22"x10'; L & S 20"x10'; S-B & E 20"x10' q. c. g; Flather 22"x10'; Bradford 21"x10'; LeBlond 16"x8'; P & W 17"x10'; Gleason 45"x12'; Johnson 36"x24'; Monarch 16"x8' (2). Hendey 14"x6' & 16" x 8'; LeBlond 21" x 12' S.P.D., Q.C.G., grd. hd.

MILLING MACHINES—Ohio No. 29 Univ.; Kemp. No. 3; Brown & Sharpe No. 3; Ceveland No. 1 single pulley dr., univ.; Amer. No. 1½; Cin. No. 3; B & S No. 3; Hendey No. 3; LeBlond No. 3; Mil. No. 3-B & Cinc. No. 3 s. p. d. pl.; Becker Model "B" & No. 6 vert.; Kemp. No. 33 spd. Prod.; Ingersoll slab, M.D. 33", table 30½"x16'; LeBlond No. 4 m. d. pl. Cin., No. 1½ Univ. M.D.; Cin. No. 4 pl. High Power; Cin. 12" Mfg. & 24" Auto. Clevel. No. 2 S.P.D., Pl. B.&S. No. 0 Pl.

PLANERS — Gray 30"x30"x10' 2 heads; Gray 48"x48"x10'; Gray 28"x28"x6' 1-hd.; Pond 32"x34"x10'; Hamilton 60"x 36"x10', 2 heads.

PUNCH PRESSES—Toledo No. 3, o.b.i.; Federal Nos. 1, 2, 3 o.b.i.; Bliss No. 62 geared; Ferracute No. P-4; Toledo No. 52 arch; Fer. No. EGF 52 Coining; Willard No. 4A o.b.i.; Swaine No. 38 arch, geared; Swaine No. 37 o.b.i.; Bliss No. 83 Reducing; Niagara No. 4½ Rock, Nos. 2 & 3; & Verson No. 4 o.b.i.

SAWS (HACK)—Racine 6x6" H. S.; Peerless 6x6" H. S. (4); Peerless 6x6" M. D. Univ. Shaping (2).

SHAPERS—S & M, G & E, Ohio, Mi., Q. City, Davis, Cin. 16"; Ohio & G & E 20"; S & M, Q. City, Rock. 24"; Ohio 26"; Cin. 24" s. p. gr. box; Rhodes 3½" Vertical; American 24" heavy, b.g. Amer. 15"; Springf. 15"; S.&M. 26", b.g.

SCREW MACHINES—W.&S. Nos. 4, 6, & 8 Hand; Nat. Acme. Nos. 515, 52, 55, 4-sp.; Gridley 4-sp. ⅝"; Automatic, B. & S. No. 00 Auto.; Grid. 4-sp., 2¼".

SLOTTER—Bement-Miles 10" vert.

SQUARE SHEARS—D & K 52" 14 GA. Power; Tol. 72", 14 ga.; Stoll 42", 14 ga.

TAPPING MACHINES—(2) Garvin No. 2 & 2X Vertical Automatic & Garvin No. 1.

THREAD MILLERS—Lees-Bradner No. 3, collet type.

TURRET LATHES — Bullard 38" vertical, rapid production. Bausch 30" M.D.; Bullard 24" vert., rap. production.

Above is only a small part of our large stock on hand

McDonald MACHINERY CO.
1531-35 N. Broadway ST. LOUIS, MO.

UNUSUAL TOOLS

No. 4 Warner & Swasey Full Univ. Turret Lathe, Bar & Chucking Equipment, Completely Rebuilt, 184,000 Serial.

Single Spindle Coulter Diamond Boring Machine, Motor Drive, Like New.

No. 16 Blanchard Grinder, 26" Chuck, 25 H. P. Motor on Spindle, 1900 Serial.

(2) Gisholt Simplimatic Lathes with Three Large Power Feed Tool Blocks, In excellent condition. Serials 18,000.

2" Buffalo Armor Plate Bar Shear, Motor Drive and Motor.

No. 2 Van Norman Duplex Mill, complete Index Head, Motor Drive and Motor, A-1 Condition ser. 8181.

(2) No. 78 Wilmarth & Morman Surface Grinders, Motor Drive.

(3) No. 3 Wilmarth & Morman Surface Grinders.

Imp Lo Swing Automatic Lathe, Front, Rear & Top Slides, Air Chuck, Two Motors, 1937 Machine.

(2) 4"x36" Lo-Swing Lathes, Motor Drive & Motor, Hardened Ways, One has back Facing Attachment, Serials No. H-5200, H-5142.

No. 4 Kempsmith Maxi-Mil., Rapid Traverse, A-1 Condition.

No. 3 Cincinnati High Power Mill, A-1 Condition, Motor Drive.

(2) Model U Lo Swing Semi-Automatic Lathes, Motor Drive.

(4) No. 3 Baush Multiple Spindle Drills, Up to 36 Spindles.

(2) 4" Bar Niles Horizontal Boring Mills, Variable Speed A. C. Motor Drive, Good Cond.

18" — 24"x8' — 12' Springfield Geared Head Lathes, Taper Attachment, Motor in Base, Late Type.

R. A. VINE'S MACHINERY WAREHOUSE

654 WEST WILLIS AVENUE :-: **DETROIT, MICHIGAN**

REASONABLY PRICED TOOLS

No. 4 KEMPSMITH UNIVERSAL MAXIMILL MOTOR DRIVE 15 H. P. 3 phase motor; Rapid Traverse—16" Index Centers.

D-31 FOX MULTIPLE DRILL, RECT. HEAD, 16"x31½" spindle centers. Bored for 36 spindles. Has ten 1¼ No. 2 Taper spindles. Power feed to head.

AUTOMATICS, Several Model A Clevelands, from ⅝" to 3¾" bar capacity.
BOLT CUTTER, 1¼" Acme single, class A; 2" Landis.
DIES and EQUIPMENT to make square cans, pt., qt. & gal, size.
DRILLS, 36" Cincinnati back geared, sliding head, tapping attachment.
No. 2 Colburn Manufacturing; 36" Snyder, back geared.
No. 12 Minster H. D.; 24" Barnes All Geared Self Oiling belt drive.
GRINDERS, 14"x72" Norton Plain; 12"x72" Landis M. D.; No. 78 W. & M. Surf. M. D.
LATHES, 38"x14' Fifield—Cheap; 16"x8' Sidney, double back geared, quick change; 14x6 Carroll Jamison; 18"x8' Lodge & Shipley, Geared Head.
MILLERS, No. 2B Brown & Sharpe plain, single pulley drive; No. 6 Becker Vertical with ball bearing countershaft; No. 3H LeBlond heavy duty plain.
PLANERS, 30"x30x8' Cincinnati, two heads on rail; 36"x15' Betts, 2 heads.
PRESSES, O. B. I.—No. 3 and 4 Walsh; No. 3 American Can.
RADIAL DRILL, 3' Prentice, gear box drive; 3' Cincinnati Bickford cone drive.
SCREW MACHINES, No. 4 Warner & Swasey plain screw machine,
3—No. 1 Brown & Sharpe wire feed; No. 4 Milholland; No. 4 Foster cone head.
1⅛"x9"; Acme cone head; No. 5 Foster grd. head—No. 4 Warner & Swasey grd. hd.
SHAPER, 28" Kelly B. G. Single pulley drive, 10 H. P. A. C. Motor.

Many other tools—exceptional "buys"—write for full details.

A. D. White Mchy. Co., 108 N. Jefferson St., Chicago, Ill.

• UNUSUAL TOOLS •

SOLD WITH AN ABSOLUTE GUARANTEE OF SATISFACTION

Drills

3, 4 & 6 Spdl Allen Hi-Speed, Power Feeds, Tapping att., latest type.
4 spdl. Cincin. Bick., direct motor drive.
6-spdl. Allen, with power feed to each spdl.
5' Carleton, Radial, motor drive.
4 spdle. Leland G & Allen 12" overhang.
No. 1 P.&W. 2 spdle. horiz. deep hole, m.d.
6 spdle. P.&W. Deep Hole, vert., indiv. m.d.
Fox, Natco & Bausch Mult. Spdle. m.d.&m.(8).
No. 121, 217, 310 and 314 Baker (8).
21" & 24" Cin. Bick. (16), direct m.d.
3' American Hi Sp. Radial, motor on arm.
3½' Morris Radial, single pulley drive.
Moline Hole Hog, various sizes (5).

Gear Equipment

No. 16 Hi-sp. Gould & E. Gr. Hobber, spd.
No. 18H Gould & Eberhardt Hobber.
No. 36 S.T.G.&E. Auto., 4 spdle. Gr. R., m.d.

Grinders

Blanch., No. 16 m.d., mtr., 36" mag. chk.
No. 126 Gardner, dble. spin. op. m.d. type, Hyd. Feed.
No. 11, 12 & 14 B & S Cyl. (8).
53" Besley vert. disc. m.d. & M.
Nos. 6, 12A & 20 Bryant Int. Chuck (12).
12" and 16"x36" Cinc. Pl. Cyl. (2).
Heald Internal Nos. 60, 70, 72, 75 (8).
No. 11 Gid. & L. Tero., hyd., inter.,m.d.&m.(4).
No. 12 Gid. & L. Ter. hydr., int. md.&M.(7).

SPECIALS

No. 12 P. & H. Boring Mill, floor type, 7" dia. quill, m.d. 5¾" dia. spdle. nose. Model "ID" Cleveland Single End Punch, m.d. cap. 2 holes, 1" through 1⅛" steel, 36" throat, Flanged ram. Latest type.

Lathes

American, 20"x10', Geared Head.
Fay Automatics 14" standard (7).
Gisholt Simplimatics (2) m.d.
16"x6' Hendey Geared Head, t.a.
18"x8' Hendey, TA, DR & Collets, BMD.
24"x12' American Grd. Hd. 28"x8' 6".
31"x10' Wickes c/s., ecc'tric hds., all m.d.&m.
24"x10' Lodge & S. Crankshaft, m.d.&m.
34"x11' Wickes Crankshaft, m.d.&m.(2).
Nos. 5A, 6A, 6C P. & J. Auto. m.d.&m. (12).
P. & J. Auto. Unimatic, m.d. &m. (2).

Mills

Mill No. 1½ Br. & Sharpe, Plain.
Mill No. 1½" Le Blond. Plain.
Mill No. 3 Kempsmith. Plain.
Gid. & L., Bor. No. 56, 6" dia. bar, app. 2 yrs. old, m.d. with hyd. duplic. attach.
Cinc., Vert., No. 4, rapid trav., late type.
Bor., 48" Bul. Vert. 2 turn. hds., dual control.
No. 2 Van Norman, BMD.
Pratt & Whitney Thread, 8x18".
Nos. 1, 2 & 3 Craftsman Rotary Production.
18" Cinc. Semi-Auto single & duplex heads.

Presses

Bliss Consolidated, O.B.I., No. 3, Grd. m.d.
Bliss Consol., O.B.I., No. 4, grd. M.D. (2).
Bliss Consolidated, O.B.I., No. 5, grd.m.d.
Cleveland, O.B.I., No. 6-I, grd. m.d., (4).
Tol. No. 9½-G, S.S., D.C.,bk.,grd.B.M.D&Mtr.
Cleveland, No. HG, O.B.I., grd. motor dr., (3).
Canco, No. 5, 8" st. S.S., BK. grd. m.d.&mtr.
Cleveland, No. 9½-P, solid back, geared m.d.
Toledo, No. 62, s.s., b.k. grd., m.d. & mtr.
Toledo No. 24, cam drawing, mtr. drive & mtr.
Bliss, No 3A, swinging ad. tbl., m.d. & mtr.
Knuckle Joint, 150 Ton Ferracute, GMD.
100 ton Oilgear Hydraulic, Vertical.
10, 25, and 50 ton Henry & Wright
No. 5A Toledo, O.B.I. flywheel type.
No. 14 Toledo Horning, geared motor dr.
No. 4A Bliss Adj. Bed Horning.
No. 204A Bliss Adj. Bed Horning, bk. gr., m.d.
No. 44 Cleveland, Adj. Bed Horning.
P-2, P-3, P-4 Ferracute, solid back, g.m.d. (12).
DG-53 Ferracute S.S., S.C., B.G., G.M.D.

Planers

24"x24"x6' Gray Double Housing, b.m.d.
42"x42"x12' Liberty Openside, m.d. & m.
60"x60"x12' Niles Bement Pond, box table.

Pipe Threaders

No. 3 Williams m.d. & m., 6" cap.
No. 316-A Oster, 6" cap.

Welders

Thompson Horiz. Butt, 35 K.W.
20-27 KVA Taylor-Winfield Spot (9).
10 KW Federal Spot (3).
100 KW Thompson Projection Spot.
200 KW Federal Projection Spot.

Miscellaneous

Automatic, 1¼" Gridley, Model G m.d. (2).
Automatic, 1¾" Gridley, Model F m.d. (2).
Polisher, U.S. Electrical Tool, motor dr. in base, 4-bearing, h.d. type (16).
Roller, Lev, 54", mtr. d., ap. 14 ga. cap.sheets
Tapper, Holmes, No, 3 Tilted, 4-spdl., late type.
Auto. Cleveland 2" Model A, (4).
1¼" Cone Auto., 4 spdle., m.d.
Bender, No. 3U Pedrick, M.d.&M., latest type.
2 sp. ¾" cap. Land Boltcut, ld. scr. att.
2 sp. 2" cap. Landis Bolt Cut., ld. screw att.
18" Gisholt Static Bal., vert. type m.d.&m.
2 sp. Coulter Dia. Borer, motor in base.
Elwell-P Lift Trucks, 3 t. & 6 t. Hi-Lift (2).
Wicaco Oil Groover, vert. type.
Nos. 2 and 3 P. & W. Profilers, m.d. (3).
Berwick Rivet Heaters, (4)
Yoder Rolls 5 & 6 spin., 2-2½" dia. shaft.
No. 6 H.S. Langelier Swager.
20" Sellers Slotter, b.m.d. Reeves Trans.
Shear, U 172 Pexto B.M.D. & Mtr.
Shear, U 252 Niagara B.M.D & Mtr.

AND A COMPLETE STOCK OF FINE UP-TO-DATE EQUIPMENT

HARVEY GOLDMAN AND CO.

10571 GRATIOT AVE. DETROIT, MICH.

WE OFFER THE FOLLOWING FROM STOCK

COCHRANE & BLY Duplex Universal Vertical Miller and Shaper.
GOULD & EBERHARDT 16" High Duty S. P. D. Shaper.
No. 2 KNIGHT Milling and Drilling Machine.
WILMARTH & MORMAN No. 78 Automatic Surface Grinder.
PELS No. 13 Combination Punch and Shear.
VAN NORMAN No. 10 Duplex Milling Machine, Motor Drive.
STANDARD No. 4 Automatic Drop Hammer, 400 lb.
BROWN & SHARPE No. 2-B Heavy Plain Miller. Motor Drive.

WE SOLICIT YOUR INQUIRIES. LARGE STOCK ON HAND.

MODERN MACHINERY CO., 243 CENTRE STREET NEW YORK CITY

24"x24"x6' Gray Planer, 1 hd.
30"x30"x8' Gray Planer, 2 hds.
P. A. Gier Straightening Presses.
Hydraulic 15 ton capacity Press.
25-ton H. & W. Auto. press, dbl. roll feed, fine condition.
50-ton H. & W. Die Mach., reb.
75-ton H.&W. Die. Mach.,ar.M.D.
150 ton H. & W. Dieing Machine
U. S. Sensitive Drills.
No. 2A 16 Spdl. Fox Mult. Drill
No. 1 Morse Taper, 95% new.
6' Western Radial.
11" Grid. Mod. F. Au. Ser. Mch.
3/8" Grid. Mod. F Auto. Ser. Mch.
1" Gridley G Auto. Screw Mch.
No. 3 Avey Auto. with 3 spdl. t.

Used Steinle Tur. L. Ser. 60203
No. 6 W. & S. T. Lathe P.F.T.S.
36"x25½' Betts-Bridgef. Lathe 15 sp. hd., sgl. pul. dr., fine condition, arr. for motor drive.
16"x6' Chard Mfg. Type Lathes.
Porter C. Lathe, no tailstock.
J. & L. 2 spdl. Tur. L. air chk.
No. 6 W. & S. Turret Lathes.
C-64-A Newton, 2 spdl. Rot. Mill, m.dr., with motor.
Sgl. Spdl. Coulter Dia. Bor. Mill, m. d. 99% new.
No. 6 Becker Vert. Mill arr. for mtr. dr., rebuilt equal to new.
Hendey Shaper (Fric.) 24" str.
20" Am. B.G. Shap., 4 step cone

20" G. & E. Back Geared Cr. Sh.
No. 272 Niag. Shear (12 ga.) m.
3' Niag. Shear—with extra blades
No. 396 Niag. Sq. Sh., arr. m.dr.
Used P. & W. Spline Mill. Mch., with Reliance 2 HP motor.
24" Silbey Drill B. G., P. F.
Fox Pt. sgl. pul. mtr. dr. mil., m.
No. 2X Garvin Tapper.
Dbl. Hd. Acme Bolt Cut. 1" cap. 90% new.
Hand Crane with 5 ton Hoist.
Air Comp. with tank & 5 HP mtr.
Landis Grinder 6"x18".
B. & S. Gear Testing Machine.
Vert. att. for No. 3H LeBlond M.

SEND FOR COMPLETE LIST

BRANDES MACHINERY COMPANY, 3030 EUCLID AVE., CLEVELAND, OHIO

LATHES

54"x18' Johnson, m. d., triple geared.
36"x16' Putnam, b. d., triple grd., q. c.
28"-35"x12' Boye & E. (raised), b.d., ch.
28"x12' Boye & Emmes, belt drive, chk.
20"x8' Amer., 12' spd. grd., hd., reg. eq.
19"x8' LeBlond, belt drive, reg. equip.
18"x14' Cinc., b. d., tap. att., chuck.
17"x6' LeBlond, b. d., reg. equip.

MISCELLANEOUS

52" King, vert. 2 hds., rap. trav., q. ch.
No. 4 Pratt & Whitney Vertical Die Sink. & Milling Mch., table 18"x72".
2" Landis Pipe Machines
14"x36" Pratt & Whitney Surf. Grinder.
18" Gould & E. Gr. Hob., cap. 30"x12"
"G" Rock River Punch 24" throat cap. ¾"x¾", motor drive

— FORGE SHOPS ATTENTION —
WE ARE LIQUIDATING THE LEBANON DROP FORGE CO.
What Do You Need?

THE O'BRIEN MACHINERY Co., 113 N. Third St., PHILADELPHIA, PA.

HIGH GRADE MACHINE TOOLS

No. 10 and 16 BLANCHARD GRINDERS—M. D.
No. 1A W. & S. TURRET LATHE, Serial 240,000.
No. 2A WARNER & SWASEY TUR. LATHE.
No. 5 FOSTER GEARED HEAD TURRET LATHE, TIMKEN BEARING.
No. 1-B FOSTER GEARED HEAD TURRET LATHE, BAR EQUIPMENT.
No. 4 WARNER & SWASEY TUR. LATHES, PLAIN AND UNIVERSAL.
24" CINCINNATI DUPLEX MILLING MCHE.
No. 3 SUNDSTRAND RIGID MILL.
No. 22 HEALD ROTARY GRINDER—M. D.
No. 6A POTTER & JOHNS. TUR. LATHE—M.D.
No. 12 BARBER-COLMAN GEAR HOBBER, Double Overarm.
24" CINCINNATI UPRIGHT DRILL—Late Type.
6-SPDLE. EDLUND HIGH SPEED DRILL.
75—150 HP SPRAGUE DYNAMOMETER.
Hundreds of other machine tools in stock.

Indianapolis Machinery & Supply Co., Inc.
1959-69 SOUTH MERIDIAN STREET INDIANAPOLIS, INDIANA

EMCO REBUILT MACHINE TOOLS

RADIAL DRILLS

6' Amer. Triple Purp., m.d. on arm, p.r. t., elec. col. clamp, 17" col. diam., late.
6' Amer. Triple Purpose, m.d. on base.
4' Amer. Triple Purpose, m.d. on base.
4' Carlton, gear box on base, incl. hd.
7' Amer. Triple Geared, gear box.
5' Dreses, gear box.
5', 6' American Triple Grd., gear box.
3½', 4' Morris, gear box.
3½' Dreses, gear box.
3' Mueller, gear box.
3' Morris, d.c. motor.
3' American Sensitive, m.d on arm.

PLANERS

55"x55"x30' Betts, revers. m.d., 2 heads.
54"x42"x12' G.A. Gray, rev. m.d., 4 hds.
48"x48"x18' Putnam, belt, 4 heads.
39"x39"x10' Cinc. Forge, belt, 2 heads.
36"x42"x12' Cinc. revers. m.d. 3 heads.
36"x36"x12' Niles, m.d., 4 heads.
36"x36"x12' Fitchburg, m.d., 3 heads.
36"x36"x10' Woodw. & Powell, blt.,1hd.
32"x32"x8' Gray, belt, 1 head.
30"x30"x12' Gray, m.d., 2 heads.
30"x30"x10' Cincinnati, belt, 2 heads.
30"x30"x10' American, belt, 1 head.
24"x24"x8' Cincinnati, belt, 2 heads.
24"x24"x6' Gray, belt, 1 head.
24"x24"x6' Ohio, belt, 1 head.
24" Cincinnati Crank, m.d.

ENGINE LATHES—GEARED HEAD

12"x6' Hdy., m.d., t.
14"x6' Hdy., m.d., t.
14"x6' American.
14"x8' American.
14"x6' Lodge & Sh.
14"x6' Prentice.
14"x8' Hendey, tap.
18"x8' American.
18"x8' Prentice.
18"x10' American.
18"x10' Prentice.
18"x12' American.
18"x14' American.
18"x18' American.
19"x10' LeBlond.
20"x8' American.
20"x9' Lehmann.
24"x10' American.
24"x12' American.
24"x10' LeB., r. & t.
24"x10' Prentice.

GRINDERS

14" Pratt & W. Vert. Surf. b. bearing.
No. 3 Brown & Sharpe Planer Type.
No. 3 Wilmarth & Morman Auto. Surf.
No. 10U Norton Lapper, m.d.
6x10x36" Norton Type G Surface, m.d.
12x36 Diamond Auto. Surf.
15x15x72" Norton Open Side Surface.
18x48" Diamond Light Duty Face.
30x84" Diamond H. D. Face.
60" Bridgeport Face.
No. 1½ Cincinnati Tool & Cutter.
No. 4 Oliver Drill.
No. 2 Cincinnati Universal 12x36".
No. 50, 55, 60, 65 Heald Cylinder.
No. 51 Besley Disc, m.d.
No. 6 Gardner Disc, m.d.
6x18", 10x36", 10x52", 12x52', 12x72", 16x32", 16x52", 16x72", 20x144" Landis Plain Self-Cont. Cyl., m.d.
8x18", 8x36", Cinc. Saddle, m.d. in base.
6x32", 10x36", 10x50", 12x72", 16x36" Norton Plain Cyl., belt and m. d
12x18" Cin., 3 m.d.; 12x36" Cin., belt.
No. 3 Bryant Semi-Auto. Hole, m.d.
No. 11 Gid. & L. Teromatic, 3 mtr. dr.
No. 12 Bryant Semi-Auto. Hole, m.d.
No. 15A Bryant Semi-Auto. 2 spindle Hole & Face, m.d.

SLOTTERS

8" Betts, belt.
10" Betts, belt
10" Niles, new
15" Newton, belt

TURRET LATHES

No. 2A W. & S. Univ., m.d., 3¼" hole.
No. 4 Warner & Swas. Univ., m.d.
No. 4 Warner & Swas. Univ., belt.
No. 1, 2, 4, 6, 8 Warner & S. Tur., belt.
No. 1 Warner & Swasey Univ. cone.
Gisholt Simplimatic, m.d.
No. 1B Foster Universal, m.d. Timken.
No. 2 Bardons & Oliver Turret, m.d.
No. 2 Gisholt Turret, m.d. in base.
No. 3, 3F Foster All Grd. Tur., m.d. in base, Timken.
No. 3 Gisholt Geared Head, m.d.
No. 6 Warner & Swasey Grd. Hd., m.d.
No. 5A, 6A Potter & John., Auto., m.d.
21", 24", Gisholt Turret, belt.
3x36" J. & L., 1 and 2 spdle. types, bar and chuck.
No. 2 Cincinnati Acme Full Univ., m.d.
No. 4, 7 Bardons & Oliver Tur., belt.
3¼", 4½" Grid. Single Spindle Auto.
3¼x36" Cinc. Acme Flat Turret, m.d.
18", 20" Acme Turret, belt.

Partial Listing only. Send us your inquiries.

THE EASTERN MACHINERY CO.

1001 TENNESSEE AVENUE -:- **CINCINNATI, OHIO**

DEPENDABLE MOREY VALUES

BORING MILLS
N. B. P. 4½" bar horiz.
Landis No. 35, 3½" bar, horiz.
Bullard 24", 36" N. E. vertical.
Gisholt 42" vertical 2 heads.
N.B.P. 44", 2 hds. vertical.
Colburn 60" vertical 2 hds.
N. B. P. 72" Vert. 2 heads.
Colburn 72", 2 hds. vertical.
Bullard 8" Mult-Au-Matic; 6 sp.

LATHES
Amer 42"x35' Engine Lathe.
American 24"x12' geared head.
Putnam 36"x28'g h., nearly new
Reed Prentice 24"x18', 24"x20'.
Lodge & Shipley 24"x12' cone.
Le Blond 25"x16' cone.
Hendey 14" to 24"x6' to 12'.
Lo Swing 8x60", latest type.
200 other lathes—all sizes.

PLANERS
Cinc. 30x30x10'; 2 hds. P.R.T.
Liberty 44x42x18'; 4 heads.
Cleve. 48"x48"x16'. 4 hds. o. s.
American 36"x36"x20'; 3 heads.
W. & P. 60"x42"x19'—4 heads.
Niles 60"x60"x12', 2 heads.
Niles 72"x72x14', 2 heads.

DRILL PRESSES
Natco Nos. 12, 13 & 22 mult. sp.
Natco C11 drill, mechanical fds.
Natco C13H drill, hyd. feeds.
Pratt & W. No. 12 rect. head.

DRILL PRESSES—RADIAL
Cinc. Bick. 3½', 4', 5', 6' plain.
Reed Prentice 3' plain.
Baush 6' plain.
Western 6' plain.
American 6' univ.

GRINDERS
Pratt & Whitney No. 14 surface.
Heald No. 20, No. 22.
Heald Nos. 55, 60, 65, 70 inter.
Heald No. 25 rotary surface.
Landis 6x18, 10x24, 12x36 pl.
Norton 10x36, 14x72 plain.
Landis 16x32, 16x48 crankshaft.
Norton type B-81, 14x30—36".
B. & S. No. 1, No. 3 univ.
B. & S. No. 30 Worm Grinder.

MILLING MACHINES
Lees-Bradner No 8 Thread.
Cincinnati No. 2 Univ. rect. overarm.
Brown & S. Nos. 2 & 3 univ.
B. & S. Nos. 2B, 3B, plain.
Hanson & Whitney Thread.
Cincinnati 18", 24", 48" auto.
Ingersoll 24x24x12', 36x36x12', 3 hd. adj. rail.

TURRET LATHES
Foster No. 1B.
Gisholt 24", 6¼" hole.
W. & S. Nos. 2, 4, 6.
Foster Nos. 2, 4.

GEAR CUTTING EQUIPT.
Barber C. Nos 3, 12 g. hobbers.
Gould & E. 18H, 36H.
Cleveland 8 spindle spline hob.
Gleason 10", 15" spiral bevel.
Gleason 24", bevel gear.
Fellows No. 8B burnisher.
Fellows Nos. 6, 61, 515, 7, 71, 7A.
Lees Bradner lapper, cap. 1¼x8"

MISCELLANEOUS
Nazel No. 8 Hammer.
Sellers 42" wheel lathe.
P. & W. 10" Vertical Shaper.
Ohio 36" Super-Dreadnaught Shaper.

MOREY MACHINERY COMPANY
410 BROOME STREET, NEW YORK, NEW YORK

Over 30 YEARS' EXPERIENCE IN REBUILDING MACHINERY

VERTICAL BORING MILLS
24" Bullard Rap. Prod., N. E. Hd.
36" Bullard New Era, M. D.
42" Gisholt.
42" King.
42" Colburn.

HORIZONTAL BORING MILLS
No. 2 Lucas, 3" bar.
No. 31 Lucas, 3 bar.
3¼" Rockford.
3½" D. & H. floor type, arr. m. d.

RADIAL DRILLS
Two—3' American.

GRINDERS
Several—6"x32" Norton plain.
10"x24" Landis plain self-contained.
No. 70 Heald Duplex.
Several No. 1 & 2 B & S. univ.
No. 2 Diamond type B surf., m. d.
No. 3 Abrasive surface, m. d.
6"x10"x48" Norton hyd. surf., m d.
No. 16 Blanchard vert. surf., m. d.
No. 16A Blanch. auto. surf., 3m.d.
No. 13 B. & S. univ. & tool.
Heim centerless, m. d.

HEADERS
Several No. 0 Wat. F. d.s.s.d.,m.d.
No. 2 Wat. F. d. s. s. d.
No. 3 Manville, d. s. s. d.
No. 3½ Waterb. F. d. s. s. d.
No. 22 Waterbury F. d. s. s. d.

LATHES
12"x6' Hendey yoke head, t. a.
14"x5' American geared head.
14"x6' American geared head, t. a.
16"x6' Monarch helical geared.
16"x6' Hendey geared head, t. a.
16"x10' Prentice, geared head, t. a.
30"x11' American.
20"x11' American, taper att.
27"x16' L. & S., sel. grd. tap. att.
28"—48"x16' McCabe dble. spdle.
26"—48"x24' McCabe dble. spdle.

MILLERS
6"x14" Pratt & W. g. h., thread.
6"x48" Pratt & Whitney thread.
6"x80" Pratt & Whitney, thread.
No. 0Y Brown & Sharpe plain.
No. 1Y Brown & Sharpe plain.
No. 1M Cincinnati plain, m. d.
No. 2 Brown & Sharpe plain.
New No. 14 Producto plain.
No. 3B Brown & Sharpe plain.
No. 4 Brown & Sharpe plain.
No. 13 Brown & Sharpe pl., m. d.
No. 33 Brown & S. auto., m. d.
No. 2 Brown & S. vertical.
No. 6 Becker vertical, m. d.
No. 5 Brown & Sharpe vertical.
No. 2 Brown & Sharpe universal.
No. 2A Brown & S. univ., m. d.
No. 3 Brown & Sharpe Univ.
24"x24"x10' Ingersoll planer.

SCREW MACHINES
Large selection B. & S., high speeds, full automatics and turret formers.
9/16" Gridley, m. d.
⅝" New Britain auto., m. d.
1"x5" New Britain Auto., m. d.
1—⅝"x7" New Britain auto., m. d.

TURRET LATHES
Several 2¼"x24 J. & L. steel head.
3"x36" J. & L. steel head.
24" Libby.

J. L. LUCAS & SON, INC.
3 FOX ST. — BRIDGEPORT, CONNECTICUT

BORING MILLS, Horizontal

3" bar Fosdick Table Type.
4" bar Gisholt, knee, M.D.
4¼" Univ. No. 44 Tri Way.
5" bar Niles Floor type.
5" Barrett No. 2 Cyl. Borer.
8" bar Beaman Smith, Floor

BORING MILLS, Vertical

72" Pond, AC, MD.
60" & 51" Bullards (2).
30" Colburn, 1 turret hd.
60" & 53" Colburn P.R.T.
10' Betts Extra Heavy Duty.

DRILLS, Radial

7' American Univ. Gear Box.
6' Amer. Univ. & Plain.
6' Mueller, Gear box, M.D.
6' & 5' Cinci. Bickfords.
3' American, Sensitive.
2, 4 & 6 Spindle Allens.
4 Spindle No. 2B Edlund.
4 Spindle Kokomo, No. 3 M.T.
No. 22½ Foote Burt.

GRINDERS

8"x54" Fitchburg Pl., m.d.
10"x36" Landis Plain (3).
12"x32" No. 2 Landis Univ.
12"x36" Landis Plain.
6"x32" Norton Plain.
14"x72" Norton Self Cont.
16"x50" Norton Self Cont.
No. 6 Bryant Chucking
18" Besly No. 26 Disc.
18" Badger No. 220 Disc.
24" Gardner No. 4 Disc M.D.
No. 16 Blanchard, Floor, M.D.
No. 11 Landis Tool & Cutter.
No. 55, 60 and C5 Heald Cyl.
14" P & W Surface M. D.
No. 2 B. & S. Surface M. D.
Heim, Centerless.

LATHES

14"x6' Cisco t.a., draw-in.
14"x6' Monarch, q.c.g., cone.
16"x8' Greaves K., Q.C.G.

LATHES (Continued)

16"x8' Hendey Cone, T.A.
16"x8' Prentice, Grd. Hd.
16"x10' L & S Cone T.A.
16/18"x8' Am., Q.C.G., Cone.
18"x8' Advance, Q.C.G.
18"x8' Lodge & S. Cone.
19"x8' LeBlond, Cone.
20"x8' Lodge & S. Cone.
20"x12' Greaves K., T.A.
20"x10' Greaves Klusman.
22/24"x8' Lodge & S., cone.
24"x12' Putnam Q.C.G., cone.
24"x10' American L. C. G.
24"x18' Pond Grd. Hd., M.D.
27"x38' Lodge & Shipley, M/D
28"x12' Boye & Emmes.
30"x18' Bridgeford turning.
32"x14' Boye & Emmes, Cone.
32"x17' Fifield, triple grd.
32"x22' Schumacher Boye.
36"x32' Putnam Grd. Hd.
42"x20' L. & S. Cone, Q.C.G.
42"x30' Johnson Grd.Hd.M.D.
48"x36' Fified, m.d.
60"x25' Gleason hvy. duty.

MILLERS

No. 2 Cincinnati Pl., Cone.
No. 3 Cinc. Univ., Cone.
No. 3 Cinci. Hi Power M.D.
No. 4 Cin. Hi Power Pl. P.R.T.
No. 4G LeBlond S.P.D.
Nos. 5, 5C, 6 & B Beck. Vert.
Model C Becker Vert. S.P.D.
Model C8 Becker Continuous.
No. 2 Cin., Univ. Grd. H. M.D.
No. 1½ B B & S. S.P.D.
No. 2 B & S Univ., Cone.
No. 3 LeBlond Univ., Cone.
24"x24"x12' Ingersoll Adj. Rail Planer Type.

PLANERS

72"x72"x18' D&H Openside.
48"x60"x12' Gray, 2 Hds.
48"x48"x12' D&H Openside.
48"x36"x10' Gray, 2 Hds.
30"x30"x9' Powell, 2 Hds.
24"x30"x6' Cinci., 2 Hds.
36" Newton Rotary, M.D.
30"x30"x10' D. & H. Openside.
24"x8' Gray; 24"x7' Niles.
24" Lynd Farquhar Openside.

TURRET LATHES

1⅛" & 2" P. & W's. (2).
3¼"x36" Cinci. Acme Grd. Hd.
3¼"x36" J & L Steel Head.

TURRET LATHES (Continued)

No. 5 Foster, 1-13/16" bar.
24" Gish., 6¼"H.S., A.C., M.D.
24" Gish., 6¼" h.s., 2 cone.
28" Gisholt M.D.
2¼"x24" & 3"x36" J. & L.

MISCELLANEOUS

Automatic, 2¼" Gridley, 1 Sp.
Billet Breaking Mach., Ajax.
Bolt Threader, 1¼" Landis.
Bolt Threader, 2" Landis.
Broach, No. 3B LaPte. M/D.
Chucking, Nos. 34 & 23 N. B.
Flanger, ¼" McCabe Pneu.
Gear Cutter, 110" Newton Spur
Gear Planer, 24" Gleason.
Gear Hobber, 6" Pfauter.
Gear Shaper, No. 61 Fellows.
Gear Generator, 11" Gleason.
Header, 1¼" Acme Rivet.
Header, 2" Acme, Steel.
Keystrs., No. 1 Bak., No. 1 Dav.
Keyseat., Nos. 2, 3 & 4 M&M
Nibbler, No. 3 Gray ¼", 36".
Pipe Mach. 4" Landis, M.D.
Pipe Machine, 8" Williams.
Pipe Machine, 12" Saunders.
Pipe Mach., 12" Curtis & C.
Pipe Mach., 2" Bignall Keeler.
Press, 400 ton N.B.P. H. Hy.
Press, No.8½ Z & H Percussion
Press, No. 61 Spec. V & O.
Press, No. 74 Bliss Consolidat.
Punch & Shear No. 47 PBC B.
Punch 54" H & J No. 2 D.E.
Punch, 36" Whit. ¾"x½".
Rolls, 8'x¼" H&J No. 2.
Rolls, 14'x1" Wickes
Rolls, 20'x⅝" H & J No. 6
Saw, 9"x9" Peer. Univ., M/D.
Saw, 9"x9" Peer. Hack, M/D.
Saw, 6" Avey Milband.
Saw, 6" Gorton No. 2B Inter.
Saw, 12"x15" Racine M/D.
Shapers, 24", 20" & 16" Cinci.
Shaper, 16" American, Cone.
Shaper, 24" Gould & Eberhardt
Shapers, 24" & 20" Queen City M.D.
Shaper, 16" Ohio, M/D.
Shaving Mach. P. & W. Vert.
Shear, 30" Cleveland, No. X.
Shear, 156"x¼" United, 36" g. 126"x¼" Amer., 22" Gap. 126"x¼" Niagara, 18" gap.
Slotter, 6" Pratt & Whitney.
Slotter 15"-18" Dill.
Slotter, 24" Newton, M/D

BENNETT-RAFKIN MACHINE TOOL CO., Inc.

Offices: 30 CHURCH ST., NEW YORK CITY

"CLEAN TOOLS"

6–75 mm. Holden-Morgan Thread Millers.
20"x20" Hydraulic 4 post, Vert. Press, 18" ram.
No. 4—48" and No. 5—60" B. & S. Gr. Cutters.
No. 272 Niagara Power Shear, 6' 14 gauge.
No. 12 Barber Colman Gear Hobber.
No. 6N American Can Gap Frame, s. s. Geared Press, 90 tons.
No. 5½ Walsh, O. B. I. Press, flywheel.
No. 5½P Walsh solid back geared Press.
No. 8 Clev. (No. 5 Equiv.) O. B. I. Punch Press.
600 Ton Canco Toggle Coining Press.
No. 2A W. & S. hi hd. Univ Tur. Lathe, Rol. fd.
No. 4A W. & S., G F. H. Univ. Tur. Lath, barfd.
Nos. 0G & 00G high spd. B. & S. Cutoff Mches.
16—No. 00 and No. 2 B. & S. full Automatics and Turret Formers.
8—No. 2 B. & S. hand Screw Mches, wire fd., P.F.
No. 2A Kearney & T., pl. Mill, sgl. arm, S. P. D.
3½' Morris plain Radial Drill, G. B. D.
20"x8' Hendy Geared Hd. Lathe, T. A., S.P.D.
29"x15' Schum. & B. Lathe, Q.C.G. 3 step cone.
6—Die Casting Machines, 11½"x12" Horizontal and 13"x17" Vertical.
14"x5' & 14"x6' Amer. Grd. Hd. Lathes, 8 spd.
No. 2 Diamond Surface Grinder, b. d., 12"x36".

LAKE MACHINERY CO.
654 W. LAKE ST., CHICAGO, ILL.

ESSLEY Machine Tools

Special Offerings

Slightly used 6' American plain radial drill, 17" diameter column., Timken bearings, 15 h. p., a. c. motor on arm.

72"x54"x24' Pond planer, 2 rail and 2 side heads.

THE E.L.ESSLEY MACHINERY CO.
831 W. EVERGREEN AVE.-CHICAGO, ILL.

Simmons-Rebuilt-Guaranteed

96"—144" BETTS HEAVY DUTY BORING AND TURNING MILL, TWO SWIVEL HEADS, DOUBLE BACK GEARED, MOTOR DRIVEN.

100" BETTS HEAVY DUTY VERTICAL BORING AND TURNING MILL, FOUR JAW CHUCK TABLE. POWER RAPID TRAVERSE, MOTOR DRIVEN.

36"—44" NILES BEMENT POND VERTICAL BORING MILL, ONE SWIVEL HEAD ON RAIL. ONE SIDE HEAD, POWER RAPID TRAVERSE, MOTOR DRIVEN.

NO. 31 LUCAS HORIZONTAL BORING, TURNING AND MILLING MACHINE WITH 3½" BAR, MOTOR DRIVEN.

DETRICK & HARVEY 5' BAR FLOOR TYPE HORIZONTAL BORING, TURNING AND MILLING MACHINE WITH POWER RAPID TRAVERSE, GEARED FACE PLATE DRIVE.

92"x87"x42' NILES BEMENT POND HEAVY DUTY PLANER, REVERSING MOTOR DRIVEN, 4 HEADS.

100" GOULD & EBERHARDT HORIZONTAL GEAR HOBBER WITH POWER RAPID TRAVERSE, CAPACITY GEARS 100" DIAM., 48" FACE.

NO. 6 BEAMAN & SMITH HORIZONTAL DRILLING AND BORING MACHINE WITH 8" DIAMETER BAR, MOTOR DRIVEN.

SIMMONS MACHINE TOOL CORP.
1725 Broadway, Albany, N. Y.
Singer Bldg., New York City

BUY WITH CONFIDENCE

BORING MACHINES

No. 1 Cleveland, 2½" bar.
No. 1 Blomquist-Eck, 3¼" bar, s.p.d.
No. 31 Lucas, 3" bar, motor drive.
No. 2 Coffman, 3¾" bar, motor drive.
No. 2 Barrett, 5" bar, extension bed.
5" Bar Niles-Bement-Pond, Fl. Type.

BORING MILLS

24" Bullard, "New Era."
30", 36" King.
42" Gisholt, motor drive.
42" King, motor drive.
48", 54", 60" Colburn.
60" Gisholt, motor drive.
72" King, motor drive.
72" Niles, Bement, Pond.
10' Niles.

DRILLS

No. 2 Colburn, 3, 4 Spindle.
No. 12 Colburn, 1 Spindle.
No. 314 Baker Heavy Duty.
No. D-4 Colburn Heavy Duty.
No. 4—5 spdl. Foote-Burt rail.
No. 1, No. 3, No. 4 Baush Multiple.
3' American triple purpose, late type.
3' Western Plain Radial.
4' Carlton plain.
4', 5' American triple purpose.
6' American Plain.
6' Western Plain Radial.
7', 8' Western heavy Radial.

GEAR CUTTERS

No. ½, No. 1 Pfauter Hobber.
No. 3—26" Brown & Sharpe.
No. 2, No. 3 Pfauter Hobber.
No. 2—60" Goss Hobber.
Nos. 6, 61, 62, 624, 645 Fellows.
No. 16 HS Gould & Eber. Hobber.
No. 24 HS Gould & Eber. Hobber.
18" Gleason Bevel Generator.

GRINDERS

20"x168" Landis Pl., Motor Drive.
26" x 96" Landis, Plain.
No. 2, 2½ Universal (Bath type).
No. 4 Landis Universal.
No. 70 Heald Internal.
No. 16-26" Blanchard vert. surface.
No. 16-A Blanchard Auto. Vert. Surface.
No. 5 Springfield Planer Type Surface.

LATHES

14"x6' Lodge & Shipley Sel. Grd. Hd.
16"x6', 8' Lodge & Shipley.
16" x 7' Lehmann grd. hd., taper. att.
16"x10' Am. grd. hd., relieving att.
18"x8' L.&S. Grd. Hd., taper att.
18" x 12' American, geared head.
19"—38"x10' Le Blond Sliding Bed Gap.
20"x10' Lodge & Shipley Grd. Hd.

NORTON MOTOR DRIVEN GRINDERS

6"x32"	10"x72"	14"x96"
10"x18"	10"-15"gapx72"	16"x50"
10"x24"	10"x96"	16"x72"
10"-15"gapx24"	14"x36"	18"x96"
10"x36"	14"x50"	18"-24"gapx96"
10"x50"	14"x72"	21"x96"
23"x120"	20"x144"	

LATHES—Continued

22"x12' L.&S. Grd. Hd. taper att.
24"x12'; 14'; 16' L.&S., grd. hd.
24"x14', 16' American, Geared Head.
24" x 22' L. & S., taper att.
27"x12' American Geared Head.
30"x11', 15' American, Geared Head.
30"x12' Lodge & Shipley, taper att.
36"x20' Le Blond hvy. geared head.
36"x24' Bradford, taper att.
46"x30' Houston, Stanwood & Gamble, m d

MILLERS

No. 1-B, No. 3-B Milwaukee plain.
No. 3, No. 4 Cincinnati, h.p., plain.
No. 4-B Brown & Sharpe, plain.
No. 1-B Milwaukee Universal.
No. 2 Brown & Sharpe Universal.
No. 3 Cincinnati Universal.
No. 3-B Milwaukee Vertical.
No. 5-B, No. 6, No. C-2 Becker Vertical.
6"x14", 6"x48" Pratt & Whitney Thread.
No. 4, No. 12 Lees-Bradner Thread.
No. 5—48" Cincinnati Hydromatic.
18" & 24" Cincinnati Auto. Duplex.

PLANERS

24"x24"x12' Gray.
30"x30"x14' Gray, reversing motor dr.
36" x 30" x 10' Gorton.
36"x36"x8', 18' Cincinnati.
36"x36"x14'—24' Cleveland Open Side.
42"x42"x30' Niles-Bement-Pond, Rev. M.D.
44"x36"x12' Gray.
48"x48"x16' Niles-Bement-Pond.
72"x48"x10' Cincinnati.
72"x60"x16' American Widened Pattern.

PRESSES

No. 01, No. 1 V&O., O.B.I., M.D.
No. 1½ V.&O., O.B.I., M.D.
No. 20 Bliss, O.B.I., M.D.
No. CG—24 Ferracute O.B.I., Geared, M.D
No. 3; No. 5 V.&O., O.B.I., grd., M.D.

TURRET LATHES

No. 5 Foster Univ., Timken Bearing.
No. 1-B Foster Universal.
No. 1-A Warner & Swasey, Motor Drive.
No. 2A W. & S., A. C. & R. F.
No. 3A Warner & Swasey, 4¾" H.S.
No. 4-L Gisholt, cross sliding turret.

HILL-CLARKE MACHINERY CO.

645 W. WASHINGTON BOULEVARD, CHICAGO

UNUSUAL MACHINES FOR PROMPT SHIPMENT

PRACTICALLY NEW 46"x32' Houston, Stanwood & Gamble Geared Head Engine Lathe. Equipped with 2 carriages, 2 taper attachments.

1—8" Bar Beman & Smith Horizontal Boring Machine. Complete with Floor Plate, Outboard Support and Extra Swive' Table.

1—4½" Bar Niles-Bement-Pond Horizontal Boring Machine. Complete with Floor Plate, Outboard Support and 4'x12' table. Machine equipped with 2 spindles, independently operated.

Large Number of Various Machines in Stock, available for prompt shipment.

ATLANTIC MACHINERY CORPORATION

149 Broadway WOrth 2 — 0662 New York City

NEW 3 Phase B. B. Motors ½ to 25 H. P., 5 H. P. $55.75

DRILLS

20" Lever, Wheel & Lever and Power Feed.
24" and 28" sliding head, back gear, power feed.
Bausch Multiple 16 spindle No. 1 Morse Taper.
4 spindle Foote-Burt, heavy duty.
6 spindle Hole Hog No. 1 Morse Taper, power fd.
1, 2 and 4 spindle high speed 8" overhang.
5' Bausch Radial Drill.
59 other drills of various sizes and types.

MISCELLANEOUS

Brake, Robinson, toggle 6'.
Brakes, 6' and 10' for 18 gauge.
Grinders, cutter and cylindrical, plain and univ.
Grinders, Bryant deep hole chucking.
Broaching machine, No. 1 LaPointe.
24"x 12' South Bend Lathe, with raising blocks.
31 other lathes 10" to 24" swing, 5' to 14' beds.
Milling Machines, Nos. 1½, 3 and 4 plain.
Milling Machine, 20"x20"x8' Ingersoll Slab, m. d.
Milling Machine, No. 1 Bilton, automatic gear.
National Acme Automatics Nos. 52, 53 and 55.
Shapers, 16", 18", 20" and 24" b. g. crank.
Turret Lathes, 21" and 24" Gisholt, m. d.
Planer, 36"x36"x14' Gray Standard Pattern.
Press, No. 24 Toledo double acting cam drawing.
MOTORS, REBUILT 3 Phase ½ to 50 HP various speeds.

This is only a partial list of our large stock, which is constantly changing. Write for what you need.

THE OSBORNE & SEXTON MCHY. CO., Dept. H. COLUMBUS, OHIO

LATHES

24"x14' Lodge & Shipley.
1—24"x12' Boye-Emmes.
20"x8' Lodge & Shipley.
18"x12' Hendey.
16"x10' Sebastian.
16"x8' Cincinnati.
14"x6' Monarch.
13"x5' Willard.

DRILLS, RADIAL

4' Western; 4' Mueller.

MILLING MACHINES

No. 1 Brown & Sharpe Univ.
No. 1½ Hendey Universal.
No. 1B Brown & S., Plain.
No. 2 Brown & Sharpe Plain.
No. 3 LeBlond Plain.

PIPE MACHINES

6" Oster.
12" Curtis & Curtis.

SHAPERS

16" Steptoe.
20" Steptoe.
24" Gould & Eberhardt.

McBRIDE & McCLENNEN *Since 1919*

Trading As

DELTA EQUIPMENT CO. 148 N. Third St., Philadelphia, Pa.

AUTOMATICS: B. & S. No. 2-G; No. 0; No. 00; Cleveland Model A; 1½".

COMPRESSORS, 500'; 268'; 156'; 90'; 68'; 42'.

DRILLS, Radial: 6' N. B. P. Univ.; 4' Bickford; 4' Cin-B; 2½'—3' Foodick; Avey, Sipp, H&W; Allen—High Speed; B. B.; Sens. 1, 2, 3, 4 sp.

GRINDERS: Internal No. 70 Heald; 14x50 Norton Pl.; 12x36 Landis Univ.

TURRET LATHES: No. 2-A Warner & S.; J & L 3x36 Chucking; J & L 2½x24 bar; Gisholt 21x3½, M.D.; No. 6 Foster Univ.

PRESSES: Bliss No. 1 Toggle; Bliss No. 306 Geared; S. S. Tierod; V. & O. No. 5 Geared; No. 21½ Bliss, Grd., O B I; V. & O. No. 2½; No. 1; O. B. I.

BLISS AUTOMATIC GANG PRESS: No. 103S; makes 8 operations simultaneously; 180 finished blanks per minute. Roll Feed.

SPOT WELDERS, 10 to 90 K. W.

MOTORS—All Sizes; large stock.

KEYSEATER, Baker No. 3, 72" capacity.

FALK MACHINERY COMPANY
18 Ward Street, Rochester, New York

HIGH GRADE TOOLS FOR QUICK DELIVERY

Lathes

14"x6' LeBlond Grd. Hd. S.P.D.
14"x6' & 16"x6' LeBlond 3 S.C.D. D.B.G.
21"x10' LeBlond, 3 S.C.D. D. B. G.
25"x16' LeBlond, 3 S.C.D., D.B.G.
14"x6' American Grd. Hd. S.P.D.
18"x8' American Grd. Hd. Lathe, S.P.D.
20"x8' American, 3 S.C.D. D.B.G.
20"x16' American, 3 S.C.D. D.B.G.
27"x12' American 8 spd. Grd. Hd.
2-18"x8' Lodge & Shipley Grd. Hd. M.D.
2-20"x8' Lodge & Shipley Grd. Hd. M.D.
30"x20' Amer. 12 speed Grd. Hd. S.P.D.
36"x22' Lodge & S. Sel. Hd. S.P.D. Taper.
36"x22' Putman Geared Hd. S.P.D. Taper.

Planers and Shapers

24"x24"x6' Gray Planer.
30"x30"x16' Gray Planer.
26" Whipp Openside Crank Planer, S.P.D.

Millers

No. 3 Cincinnati Plain, 3 S.C.D.
No. 3 Cincinnati H. P. Univ., 3 S.C.D., D.B.G.
No. 4 Cincinnati Hi.P. Cone 3 S.C.D.D.B.G.
No. 4 Cinc. H.P. Cone Univ. 3 S.C.D., D.B.G.
No. 2 Cincinnati Plain Cone.
No. 2 Kempsmith Cone, M.D.
No. 3 Heavy Oesterlein, Cone Universal.

Grinders

No. 33 Abrasive Surface M.D.
No. 2 B & S Surface M.D.
No. 1 Diamond Surface Grinder.
No. 50, 550, 60, 65, 70 Heald Internal.
6"x18" Landis Plain, Self Contained.
10"x36" Landis Plain, S.C.
12"x36" Landis Plain, S.C.
12"x4" Modern Plain, Belt drive.
12" Pratt & Whitney Plain Surface Grinder.

SPECIAL

7" Diameter bar Niles Bement Pond Horizontal Floor type Boring Mill, Motor Driven.

36" Cinc. Openside Crank Planer, M.D.
16, 20, 24" G & E Shapers, cone drive.
32" Gould & Eberhard, H.D., M.D.
16, 20, 24 and 28" Gould & E. Shapers, S.P.D.
20" Amer. Shaper, M. Mak. Tbl. & vise. S.P.D.
16" Ohio Crank Shaper, Cone drive.

Radial and Drill Presses

2½' Fosdick Plain S.P.D.
3' Fosdick, S.P.D.
3½', 4', 5', 6' Amer. Triple Geared S.P.D.
4', 6' American Triple Purpose S.P.D.
6' American Trip. Purpose, M.D.
4' Dreses Plain Radial, s.p.d.
21", 24" Cinc. B. Upright Geared Feeds.

Gear Cutters

No. 1, 2, 3 Adams Farwell Gear Hobbers.
18H Gould & Eberhardt Gear Hobbers.
No. 11 B & S spur and bevel Gear Cutter.
No. 3-26", 3-36", No. 4-36" B & S Gear Cutters.
Gleason Spiral Bevel Generators and finishers.

Boring Mills

60" Gisholt Vertical Rapid Traverse. S.P.D.
7" Niles Bement Pond Horz. Plain M.D.
60" Niles Car Wheel Borer.

Turret Lathes

No. 3 Cincinnati Acme, Arr. M.D.
No. 7 Foster Univ.
No. 4 & 6 W & S Plain Cone Drive.
14"x19" Fay Automatic.

Miscellaneous

Model W Cleveland Pch. & Shr. 60" thrt., M.D.
1" Ryerson Lennox Rotary Bevel Shear M.D.
8'x¼" Chicago Bending Brake.
6'x3/16" Chicago Bending Brake.
5'x10 gauge V.K.V. Press Brake.
10'x3/16" Sholl Power Squaring Shear M.D.
6"x6" Peerless Shaping Saw.
9"x9" Peerless H./S. Saw.

CINCINNATI MACHINERY & SUPPLY CO.

217 EAST SECOND STREET **CINCINNATI, OHIO**

AUTOMATIC SCREW MACHINES

	Mod.	Ser. No.	Driv.
Cleveland			
25—⅜" to 5½"	A	28-34,000	Plain
Brown & Sharp			
No. 00, full auto.		5349	Plain
No. 00, cut off,		5514	Plain
No. 6 Full automatic			s.p.d.
Gridley			
1—1¾" 4 spdl.	F	6624	10 H.P.
1—2¼" 4 spdl.	F	2500	10 H.P.
1—2⅝" 4 spdl.	F	8568	Plain
2—9/16" 4 spdl.	G	10,000	5 H.P.
6— ⅞" 4 spdl.	G	10000	5 H.P.
2—1¼" 4 spdl.	G	10000	5 H.P.
2—4¼" 1 spdl.		4,000	Plain
Cone			
6— ⅜" 4 spdl.		600 up	5 H.P.

HAND SCREW MACHINES

Acme, plain head, ⅝"x4" Belt Drive.
B. & S. No. 1 plain head, ⅝"x3", belt drive.
Foster No. 3 fric. B. G., P. F. turret.

DRILLS

Leland Gifford, h. s., b. b., sensitive, ⅜" ca.
Demco h.s., b.b., ⅜" capacity.
1, 2, spdl. Allen, h.s., b.b., 4 spdl. Washb.
2 sp. Leland-G. h.s., b.b., sens., ⅜" cap.
4 spindle Allen h.s., b.b., p.f., cap. ⅞".
Drills, 28", 30", 32", sliding head, belt drive.
Drill, Baker No. 310, h.d., No. 5 M.T., m.d.

GRINDERS

Gear cutter, No. 23 Brown & S., 8" cap.
No. 10 Besley disc. 18" dia., discs., b.d.
No. 6 Gardner h.s., ball bearing.
Grinder, Landis, 10x20 plain.
Webster & Perks 6x30 m.d., self.cont., c/s.

KEYSEATERS

No. 2 Mitts & Merrill b.d., fully equipped.
No. 2 Davis, fully equipped, b.d.

LATHES

Gisholt 21 Universal Turret Lathe.
Hamilton 16 x 8 q.c., d.b.g., 2 chucks.
Monarch, 20 x 8, q.c., d.b.g.
Bradford 24 x 10, q.c.s., b.g. rais. blocks.

MILLERS

Hand Millers, Kent Owens, Chicago.
No. OY Brown & Sharpe, power feed.
No. 2 Knight vert., univ. Slotter.
Boring Mill, Horiz. Rochester, 3" bore. M.D.

PRESSES

25 ton Henry-Wright, dieing, with feeds, b.d.
No. 15 Robinson, horn type with table and motor, a.c. 220 volts.
Waterbury F. s.s., grd., 8" str., 30 ton.
DG56, Ferracute, tog., 4½" and 9" str., 100 t.
Hercules 15 t. pwr. forg. or broach., m.d.
No. 59 Toledo St. Side gear press M. D. 35 h.p.
No. 3 R & K, O.B.I., 2½ str.

MISCELLANEOUS

20" Amer., back grd., crank, vise, c/s.
Little Giant, 100 lb., belt drive.
Threading machine, 2" Landis belt drive.
Planer, 24x24x6 Ohio heavy duty, 1 head.
Saw, No. 2 Klem, band, for metal cutting, b.d.
Separator, American, Cap. 1½ bushels, belt d.
Separator, McKinzie, for chips, blwr. type.
Tapper, Garvin No. 2, cap. ½" and ¾", b.d.
Napier Band Saw, 10"x10", Model B.
12"x36" D & W Magnetic Chuck.
½" National Acme Stud Threader.
100 H. P. Venn Severin Diesel, complete.

SCOTT MACHINERY SALES, INC. 1811 Carroll Av., Chicago, Illinois

MISCELLANEOUS MACHINES

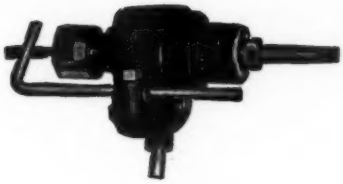
16x12 Sundstrand Stub Lathe, fac. att.
11" LeBlond hvy. duty automobile lathe.
No. 1B Foster timken. spdle. univ. tur. lathe.
26" Model C Libby hvy. duty tur. 4½" bore.
26" Model C Libby hvy. duty tur. 7½" bore.
No. 2A Warner & Swasey univ. turret lathe.
No. 3A Warner & Swasey univ. turret lathe.
24" Gisholt turret lathe, 6½" bore.
52" King vert. boring mill, 2 swiv. hds.
52" Gisholt boring mill, 2 swiv. hds.
No. 5 Defiance horizontal 3" bar.
Rockford hydraulic horiz. bore, 54" tble.
No. 3XA Oilgear hydraulic broach.
Twin Ten Oilgear hydraulic broach.
2" Landis double bolt cutter.
3" Landis single bolt cutter.
C-12 Natco rect. hd. multiple drill.
No. 13 Natco rect. hd. multiple drill.
No. 14 Natco rect. hd. multiple drill.
No. 40 Natco straight line multiple drill.
No. 60 Natco 3-way multiple drill.
20" Cinci. 4-spindle gang drill.
2½" cap. Minster hvy. duty drill, reverse.
7-spdle. No. 2 Foote-Burt gang drill.
Moline 16-spdle. vert. guide hole driller.
No. 12 Barber-Coleman gear hobber, m. d.
28" Flather automatic gear cutter.
12x18" Cinci. plunge cut. grinder, m. d.
48" Newton dble. spdle continuous miller.
Sellers drill grinder, t. & l. pulley dr.
No. 304-A Oster pipe machine, 4" cap.
No. 7 Cochrane-Bly 15" cap. cold saw.

WE CARRY A LARGE STOCK OF USED MACHINE TOOLS.
Your inquiries will be appreciated.

The Strong, Carlisle & Hammond Company

1392 West Third Street, CLEVELAND, OHIO
Branch Office: 2832 East Grand Blvd. DETROIT, MICHIGAN

VICTOR'S BARGAINS IN NEW DORMAN TAPPING CHUCKS



3/8" Capacity Furnished with No. 1 or 2 Morse Taper Shank
$19.75

3/4" Capacity Furnished with No. 2 or 3 Morse Taper Shank
$29.75

1" Capacity Furnished with No. 3 or 4 Morse Taper Shank
$39.75

Money Refunded If Not Satisfied *Send for Our General Catalogue*

VICTOR MACHINERY EXCHANGE, Inc.

251 Centre Street, New York, N. Y.

Automatics, No. 00G Brown & Sharpe, M. D.
Band Saw, No. 0 Marvel Metal, Motor Drive.
Drills, 4 spindle Aveymatic & Leland-Gifford.
Grinders, Surface, No. 2 B. & S.; No. 3 Reid.
Grinders, Disc, No. 27 Gardner, Motor Drive.
Hack Saws, 6x6, 9x9, 13x16 Peerless.
Lathes, 14"x6' American Geared Head.
Lathes, 20"x8' American.
Lathes, 32"x22' American Geared Head, M. D.
Mill Machines, No. 2A Brown & Sharpe, Univ.
Punch Presses, O. B. I. Nos. 1 to 5.
Punch Presses, No. 7½ Bliss Trimming.
Punch Presses, No. 55 Cleveland 180 Ton.
Punch Presses, No. 3½B Bliss Toggle.
Shears, No. 55 Beloit Combination.
Shapers, 20" Rockford Hy-Service, Motor Drive.
Shapers, 24" Stockbridge, Motor Drive.
Screw Machines, No. 4 Warner & S. G. H., M. D.
Turret Lathes, No. 1B Foster Universal, S. P. D.
Welders, Arc, 200 and 400 Amp Lincoln.
Welders, Spot, 9-10-15 K. W. Taylor-Winfields.

VICTOR MACHINERY CO. 130-132 South Clinton St., Chicago, Illinois

— PARTIAL LIST —

No. 16 Blanchard, Direct Motor Drive.
No. 4 LeBlond Plain Miller, S. P. D.
No. 2 Cincinnati plain miller, cone.
16" Steptoe Shaper, Cone.
4½' Morris Radial, Gear Box, S. P. D.
3½' American Radial, Gear Box, Swinging and Swivel Table, S. P. D.
No. 1 Hoosier Hvy. Duty Drill, 2" cap. M. D.
24"x12' South Bend 36" Gap Lathe, Cone.
24"x10' Swings 27½" Greaves-Klusman Hvy. Duty Lathe, 20" 4-Jaw Chk., Cone.
21"x12' LeBlond, Hvy. Duty Lathe, Cone.
16"x48" Landis Crankshaft Grinders, Self-Contained Countershafts, Motor Drive.
No. 2½ Bath Universal Grinder and Attachments.

IROQUOIS MACHINERY CO., 660 Ohio St., Buffalo, N. Y.

6' American Radial Drill, triple gears, S. P. D.
5' Niles Full Universal Radial Drill, Equipt. with Variable Speed Motor.
No. 2 Cincinnati Plain Cylindrical Grinder, Cap. 12"x48" Belt Drive.
No. 2 Cincinnati Universal Cylindrical Grinder, Cap. 12"x36" Belt Drive.
10' Ohl Squaring Shear, Cap. 14 Gauge, Underdriven.
11' Atlas Vertical Boring Mill, Old Style and Real Cheap.
24" Cincinnati Shaper, Cone Drive.
200-Ton Niles-Bement-Pond Hydraulic Wheel Press.
400-Ton N.-B.-P. Hyd. Wheel Press, Steel Cylinder and Steel Tie Rods.
36"x32"x14' Cincinnati Planer, 2-Heads on Rail, Belt Spur Drive.
71"x48"x14' American Planer, 2-Heads on Rail, Plain Spur Drive.
13"x16" Peerless Hack Saw, A. C. Motor Drive.
40"x18' Prentice Lathe, Equipped with Raising Blocks to 52½" Cone Drive.
20" Barnes 4-Sp., Gang Drill, C. D.; 25" Barnes 4-Sp, Drill, Camel Bk., S. P. D.

OVER 300 OTHER MACHINE TOOLS IN STOCK.

THE NORTON-BROADWAY MACHINERY CO., 610 Baymiller Street, CINCINNATI, OHIO

AUTOMATICS:
B. & S. No. 0 & No. 00.
B. & S. No. 00 Turret former.
Clev Mod A, ⅞"; Mod B, 1½".
R6, 6 sp. No. 2 2,000.
Grid. Mod G, ⅞" ModF, 1¼"
BOR. MILL, HOR.
Binsee, 3¼" bar.
DRILLS:
Aurora 20" Sliding Hd. H. D.
1—3 Spindle ½ inch.
1—4 Spindle ½ inch.
Washburn ⅝" 2 s. p.
GEAR CUTTER
B. & S. No. 13 Automatic.
B. & S. Gear Tester.
B. & S. Gear Tooth Rounder.
GRINDERS:
Landis No. 2 Universal.
No. 3 B. & S. Univ. Tool & Cut.
10"x36" Norton cyl. c.s d.(3).
Norton Pl., 6"x32", (2).
W & M dbl. end drill grinder.
Heald Internal No. 55.
LATHES:
Hendey Yoke hd., 14"x6' Ser. No. 20,000, tap. att., C. D.
Rockford 14"x6' Eng. Q.C.G., 3 Step C. D. Prod.
LeBlond h. d., 18"x12', c. d.
MILLERS:
Cinc. No. 2 Universal, all att.
Garvin No. 2A Univ., all att.
PIPE THREADERS
Rogaco Portable 2" (2).
Oster 4" B. D.; Apex 6" B. D.
PLANERS:
P & W., 40"x40"x10'.
SHAPERS:
Potter & Johnson 15" Sw. Tble.
Sim. 16" tilting table, vise.
Stockbridge 20" crank, vise.
TURRET LATHES:
J. & L., 2¼"x24".
W & S 1¼", & P & W ⅝" (2).

We Specialize In Rebuilding Automatic Screw Machines, Manufacturers of the Rogaco portable pipe threading machine.

Triplex Machine Company, 117 Fourth St., Pittsfield, Mass.

15,000 STACKING BOXES

Illustration shows boxes stacked 3 high

Excellent Condition.
24"x15"x7½—16 gauge.
Drop Handles Both Ends.
Weight 16 lbs.
Olive Green Finish.

$1.00 each

18,000 Used One Piece Steel Tapered Tote Pans

50¢ ea.

21x14x5½—16 gauge

PASSMAN BROTHERS

705 W. Washington Blvd., Chicago, Illinois

VERTICAL BORING MILLS

16' Betts; 2 swivel heads; M. D.
54" Bullard New Era Type Vert. Turret Lathe; Motor Drive.
53" N.-B-B.; 2 swivel hds.; Power Rapid Traverse; Motor Drive.
44" N.-B.-P.; 2 swivel hds., Pwr. Rapid Traverse, Motor Drive.
48" Colburn; 2 swivel hds., S.P.D.

HORIZONTAL BORING MILL

4½" bar Niles-Bement-Pond Duplex Control Table Type; M. D.

MILLING MACHINES

No. 2 Cincinnati Univ.; Belt Dr.
No. 33 B. & S. Auto.; Mtr. in Base.

LATHES

30"x17' Houst., Stan. & G.; B. D.
26"–48"x28' McC. Dbl. Sp. B. D.
24"x18' Springfield; Motor Drive.
20"x8' Hendey Grd. Hd.; M. D.
16"x8' Lodge & Shipley; B. D.
18"x8' National; B. D.
14"x6' Hendey Grd. Hd.. Taper, Motor Drive.
14"x6' Hendey; B. D.

GRINDERS

No. 16 Blanchard Direct Mtr. Dr. Vert. Surf.; 26" mag. chuck.
No. 33 Abrasive Surf.; Mtr. in Base
No. 3 Abrasive Surf.; Mtr. in Base.
No. 2 Brown & Sharpe Surface.
No. 24 Gard. Hor. Disc; 53" dia.
No. 14 Gardner Disc; 20" dia.
No. 8 Badger Ball-Bearing Disc.

TURRET LATHES

No. 3A Warner & S. Univ.; M. D.
18" Libby; 3-9/16" spindle; M. D.
24" Gisholt; 6¼" spindle; B. D.
3"x36" Jones & L.; S. P. D.

AUTOMATIC SCREW MCHS.

9/16" Acme 5-Spdl. Model "C"; Slot. Attach.; Motor Drive.
1¼" Cone 4-Spindle; Motor Dr.
1¼"-1½" Cleveland Model "A".

RADIAL DRILLS AND DRILL PRESSES

7' Cincinnati Bickford; M. D.
5' Cincinnati Bickford; M. D.
3' & 4' American; M. D.
No. 2 Avey 4-Spindle; M. D.

MISCELLANEOUS

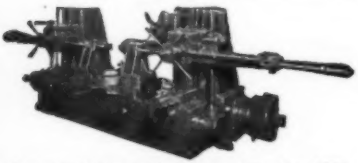
GEAR HOBBER, No. 12 Barber Colman.
HAMMER, 300-lb. Bradley Helve.
PLATE PLANER, 18' Hilles & Jones; ¾" cap.
KEYSEATER, No. 2 Baker; M.D.
PRESS, No. C-4; Inclinable Ferracute
HYDRAULIC RIVETER, 150-ton Chambersburg; 6" stroke.
ROLLS, Wickes; vertical type; cap. 12'x1½"; largest roll 23" dia.; 2 smaller rolls 17" dia.
SHAPER, 24" G. & E.; M. D.
SHAPER, 16" G. & E.; B. D.
SLOTTER, 24" Newton; 42" rotary table; M. D.
SHEAR, Hilles & Jones Throatless.

SUN MACHINERY COMPANY, INC.

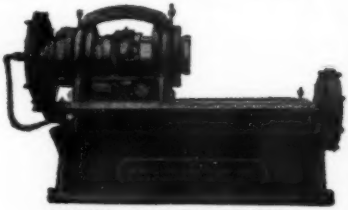
36 VAN VECHTEN STREET, NEWARK, N. J.

Are you in need of a tool for some special work?

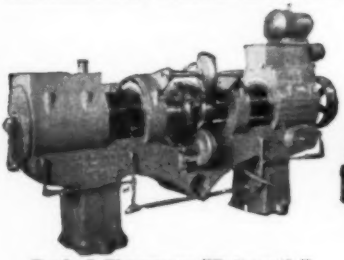
On this page are a few of the many machines we have that can be adapted to your needs with a few minor changes or may be used as they are at present. Our low price on these and others will justify their purchase.



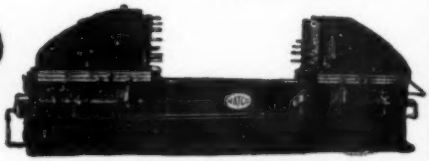
Cleveland 3-Way Horizontal Boring Mill



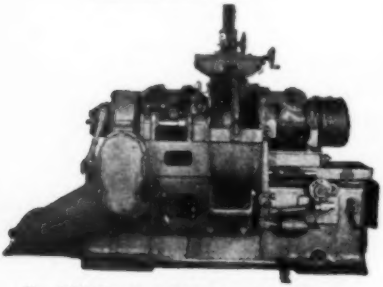
Hall Planetary Thread Miller



Davis & Thompson "Rotomatic" Double-End Drills



Natco Horiz. Hyd. Double End Multiple Drill



No. 84A Gardner Prod. Opposed Head Grinder

No. 45 Producto-Matic Drill

WRITE US FOR PHOTOS AND FULL DESCRIPTION

Ask for a Copy of Our No. 39 Handy Pocket Reference

LOUIS E. EMERMAN & CO.

1761 ELSTON AVE., CHICAGO, ILLINOIS

Advertisers Index

Aaron Machinery Co. 177
Abart Gear & Machine Co. 138
Acme Equipment Company 182
Acme Industrial Co. 111
Acro Welder Mfg. Co. 123
Advance Machinery Co. 183
Air-Way Pump & Equipment Co. 128
Alco Tool Company 153
American Tool Works 146
Ames Company, B. C. 126
Anderson Bros. Mfg. Co. 92
Armglo Company 161
Armstrong-Blum Mfg. Co. Inside Front Cover
Armstrong-Bray & Co. 134
Armstrong Bros. Tool Co. 16
Atlantic Machinery Corp. 202
Atlas Press Company 44
Auto Moulding & Mfg. Co. 96
Avey Drilling Machine Co. 4

Baldor Electric Co. 137
Bansbach Machinery Corp. 184
Bates Marking Devices, H. O. 164
Baumbach Mfg. Co., E. A. 96
Beatty Mch. & Mfg. Co. 14
Bennett-Rafkin Machine Tool Corp. 199
Bergram Mech. Eng. Co. 163
Berkeley Equipment Co. 211
Bernstein & Co., Geo. M. 191
Beverly Shear Co. 134
Black Diamond Saw & Mch. Works 135
Blank & Buxton Machinery Co. 123
Bleser Machinery Co. 179
Botwinik Brothers 188
Boyar-Schultz Corp. 14
Brandes Machinery Co. 196
Bremil Mfg. Co. 124
Bridgeport Machines, Inc. 47
Brooks Co., B. D. 181
Brown & Sharpe Mfg. Co. 35, 117
Brown Machinery Co. 188
Bryant Chucking Machine Co. 56
Buffalo Forge Co. 62
Burgess Battery Co. 120
Burke Machine Tool Co. 98
Burr & Son, J. T. 154

Canedy-Otto Mfg. Co. 99
Capitol City Iron Works 184
Carboloy Co., Inc. 138
Carlson Mfg. Co., C. H. 116
Carroll & Son, Wm. 146
Cerro de Pasco Copper Corp. 127
Chicago Die Casting Mfg. Co. 78
Chicago Gear Works 143
Chicago Pneumatic Tool Co. 43
Chicago Tool & Engineering Co. 41
Chicago Wheel & Mfg. Co. 106, 107
Cincinnati Electrical Tool Co. 212
Cincinnati Machinery & Supply Co. 203
Clausing Manufacturing Co. 147
Clinton Machinery Co. 192
Colonial Broach Co. 66
Colonial Hotel 139
Colwell, S. G. 174
Continental Machines, Inc. 79
Conway Clutch Co. 69
Cullman Wheel Co. Back Cover
Cushman Chuck Co. 39

Daniels, C. R. 181
Danly Machine Specialties 74
Davis Mchy. Co. 179
Dearborn, J. W. 110
Delta Equipment Co. 202
Delta Manufacturing Co. 83
Desmond-Stephan Mfg. Co. 134
Detroit Stamping Co. 152
Detroit Surfacing Machine Co. 61
De Witt Tool Co. 191
Dony Machinery Co., D. E. 179
Dreis & Krump Mfg. Co. Inside Back Cover
Dremel Mfg. Co. 115
Drive-All Mfg. Co. 101
Duro Metal Products Co. 87
Dyer Welder & Engineering Co. 127

Eastern Centerless Grinding Co. 169
Eastern Cutter Salvage Corp. 108
Eastern Machinery Co. 197
Eastern Mch. Screw Corp. 170
Economy Machine Products Co. 156
Eisler Engineering Co., Inc. 133
Ektrom Carlson & Co. 55
Electromatic Products Co. 42
Elgin Tool Works 37
Elyria Belting & Machinery Co. 184
Emerman, & Co., Louis E. 208
Erickson Steel Co. 90
Errington Mechanical Laboratory 159
Esco Eng. & Sales Co., Inc. 151
Essex Brass Corp. 128
Essley Machinery Co., E. L. 200
Etco Tool Co. 95
Excelsior Tool & Machine Co. 119
Failor-Strafer Machinery Co. 180
Falk Machinery Co., Inc. 202
Famco Machine Co. 140
Federal Press Co. 71
Federal Products Corp. 109
Flexrock Company 102
Flynn Mfg. Co. 154
Ford Mfg. Co., M. A. 119
Fulflo Specialties Co. 73

Galland-Henning Mfg. Co. 85
Gallmeyer & Livingston Co. 124
Gardner Machine Co. 59
Gaston Power Tools Co. 104
General Blower Co. 183
Gits Brothers Mfg. Co. 121
Glenzer Co., J. C. 10
Gorton Machine Co., Geo. 80-130
Graham Mfg. Co. 132
Grant Mfg. & Machine Co. 139
Greenerd Arbor Press Co. 133
Grobet File Corporation of Am. 157-158
Hamilton Tool Co., The 163
Hannifin Mfg. Co. 3
Hardinge Brothers, Inc. Front Cover
Harris Electric Supply Co. 185
Harrison, Inc., Robert E. 179
Hartford Special Machinery Co. 122
Harvey Goldman & Co. 195
Harvey Mfg. Company 122
Haskins Company, R. G. 49
Heim Co., The 169
Heimann Mfg. Co. 162
Heuser Manufacturing Co. 170
Hill-Clarke Machinery Co. 201
Hobart Brothers Co. 1
Hotels Madison & Lenox 163
Hyman & Sons, Joseph 180

Illinois Gear & Mch. Co. 170
Illinois Testing Laboratories, Inc. 110
Indianapolis Machinery & Supply Co. 196
Indianapolis Screw Products Corp. 185
Industrial Centerless Grinding Co. 169
Industrial Machinery Co. 180
International Mchy. Co. 184
Interstate Machinery Co. 186-187
Iroquois Machinery Co. 206

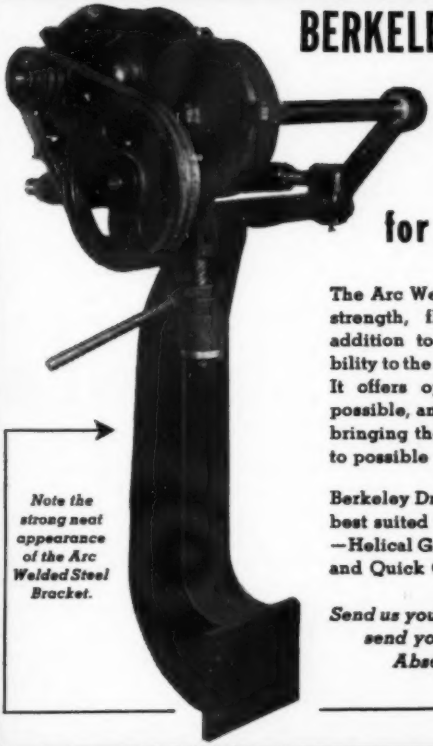
Jacobs Mfg. Co. 33
Johnson & Sons Machinery Co., Wm. C. 182-190
Johnson Tool Co., Inc. 148
Jones Machine Tool Co. 178

K-O Products Co. 157
Kalamazoo T. & S. Co. 12
Kearney & Trecker Corp. 25
Klauber Machinery Co., E. L. 183
Koch Test Indicator Co. 42
Koebel Diamond Tool Co. 112

Advertisers Index

L-W Chuck Co. 105
Lake Machinery Co. 200
Landis & Gyr, Inc. 98
Lang Machinery Co. 181
Laurens Bros. 192
Lee & Son Co., K. O. 114
Libert Machine Co. 84
Lima Armature Works 164
Littell Machine Co., F. J. 172
Lockwood Manufacturing Co. 178
Logeman, T. V. 184
Loshbough-Jordan Tool & Mch. Co. 130
Lowe Co., Chas. E. 178
Lucas & Son, Inc., J. L. 198
Luma Electric Equipment Co. 152
M. & S. Dresser Company 120
McDonald Machinery Co. 193
McKenna Metals Co. 90
Madison-Kipp Corp. 88
Mall Tool Company 53
Marr-Galbreath Machinery Co. 179
Marshalltown Mfg. Co. 76
Master Chrome Service, Inc. 108
Master Tool Co., Inc. 108
Mayer Machinery Co. 181
Metal Carbides Corp. 140
Meyer Machinery Co., Walter H. 177
Midwest Tool & Engineering Co. 142
Miles Machinery Co. 189
Milliken Machine Co. 132
Modern Machinery Co. 196
Modern Machine Corp. 96
Moore, Geo. W. 139
Morey Machinery Co., Inc. 198
Morris Machinery & Co., Inc. 187
Morrison Machine Products 6
Moser Machine Tool Sales 182
Motor Tool Mfg. Co. 60
National Machine Tool Co. 160
Nedco Co. 144
Nelson Machinery Co. 183
New Britain Tool & Mfg Co. 110
New Method Steel Stamps, Inc. 168
Nicholson File Co. 29
Nielsen, Inc., 142
Nielsen Tool & Die Co. 172
Nilson Machine Co., A. H. 2
Norgren Co., Inc., C. A. 125
Norton-Broadway Machinery Co. 206
Nutmeg State Machinery Corp. 178
O'Brien Machinery Co. 196
Oliver Instrument Co. 147
Osborne & Sexton Machinery Co. 202
Owatonna Tool Co. 94
Paasman Bros. 207
Peters Tool Co. 86
Plunket Machine Co., J. E. 154
Porter-Cable Machine Co. 178
Postel Filing Mch. Co. 114
Pratt & Whitney 9
Precision Tool Co. 165
Printz Electric Co. 54
Procunier Safety Chuck Co. 15
Progressive Tool & Cutter Co. 144
Pyrometer Instrument Co. 150
Quality Hardware & Machine Co. 125
Quality Tool Works 100
Quality Tool & Die Co. 169
R & L Tools 97
Racine Tool & Mch. Co. 129
Reeve-Fritts Co. 182
Reich Mfg. Co., J. R. 168
Reliance Machinery Sales Co. 178
Remco Products Corp. 94
Rigid Tool Holder Co. 171
Riverside Machinery Depot 190
Rivett Lathe & Grinder, Inc. 5
Rockford Drilling Mch. Co. 141
Rockford Iron Works 155
Rosenkranz, Weisbecker & Co. 177
Russell Boring Bar Co. 168
Russell Machine Co. 180
Ryerson & Son, Inc., Jos. T. 20
S & S Machine Works 112
Schauer Machine Co. 146
Scherr Co., George 153
Schmidt, Geo. T., Inc. 65
Scott Machinery Sales 204
Segal Machinery Co. 182
Sellers & Co., Wm. 31
Seneca Falls Machine Co. 89
Severance Tool Mfg. Co. 150
Shaw-Box Crane & Hoist Division 118
Sheldon Machine Co. 166
Siegman Machinery Co. 177
Simmons Machine Tool Corporation 200
Skilsaw, Inc. 7
Smith Power Transmission Co. 129
South Bend Lathe Works 18-184
Southern Products 169
Stackbin Corporation 161
Standard Machinery Co. 177
Standard Pressed Steel Co. 131
Stanley Works 103
Star Machine & Engineering Corp. 172
Steege Machinery Co., W. L. 148
Strohm, W. A. 185
Strong, Carlisle & Hammond Co. 204
Sun Machinery Co. 207
Sundstrand Machine Tool Co. 51
Surplus Stock & Machinery Co., Inc. 181
Sutton Tool Co. 136
Tannewitz Works 162
Taylor Machine Co. 156
Taylor Sales Co. 124
Tomkins-Johnson Co. 11
Torq Electric Mfg. Co. 104
Tranter Mfg. Co. 177
Trico Fuse Co. 143
Triplex Machine Co. 206
Troyke, Alfred A. 112
Turner Uni-Drive Company 113
U. S. Electrical Motors, Inc. 8
United Precision Products Co. 155
Universal Engineering Co. 74-116
Used and Rebuilt Machinery 177-209
Victor Machinery Co. 206
Victor Machinery Exchange 205
Vimco Mfg. Co. 128
Vinco Tool Co. 131
Vine, R. A. 194
Vonnegut Moulder Corporation 159
Wachs-Gregg & Co. 182
Wade Instrument Co. 126
Wade Tool Co. 175
Walls Sales Corporation 144
Walton Co. 166
Wardwell Mfg. Co. 54
Wells Manufacturing Co. 75
Western Tool & Mfg. Co. 98
Western Tool Exchange 184
Westlof Tool & Die Co. 135
West Penn Machinery Co. 183
White Machinery Co., A. D. 194
White, Daniel M. 184
White Dental Mfg. Co., S. S. 27
Whitney Metal Tool Co. 13
Wigglesworth Machinery Co. 180
Wilmington Fibre Spec. Co. 180
Wilson, K. R. 145
Wisconsin Gear & Eng. Co. 180
Wittek Manufacturing Co. 141
Wodack Electric Tool Co. 60
Wyzenbeek & Staff, Inc. 91
Zagora Mch. & Gear Co., J. 86
Zeeve, Alex 178
Zeh & Hahnemann Co. 158

ARC WELDED STEEL BRACKET CONSTRUCTION



Note the strong neat appearance of the Arc Welded Steel Bracket.

BERKELEY DRIVES are Designed and Custom-Built Specifically for your Machine

The Arc Welded Motor Drive Unit offers strength, flexibility and rigidity, in addition to its feasibility and adaptability to the difficult conditions imposed. It offers opportunities not heretofore possible, and economies of manufacture, bringing the advantages of motorization to possible complete realization.

Berkeley Drives are available in the form best suited to your requirements. V-Belt —Helical Gear—Variable Speed (P.O.S.) and Quick Change Gear Drives.

Send us your specifications and we will send you complete information. Absolutely no obligation.

The BERKELEY EQUIPMENT Co.

Corry Pennsylvania

Announcing the $5.00 WINNERS
for the Best Catch Lines for this
Hillbilly Cartoon advertising
The Cincinnati Line of
Grinders and Buffers
Watch for Next Contest -- to Appear Soon!

"February Second." By George A. Healy, 635 Garfield Ave., Aurora, Illinois.

"Obsolescence." By L. R. Matthews, 6368 London Street, Detroit, Michigan.

"The old grindstone takes a backseat." By Gerald G. Gifford, 58 S. Huron Ave., Columbus, Ohio.

The judges were unable to narrow the field to one prize winner. All three of these entries, the judges said, were first prize winners. So we're sending a $5.00 check to each of the three entrants. Congratulations, prize winners! Many thanks to all contestants, better luck next time.

and here's another WINNER

THE Air Master

First in safeguarding health—first in protecting expensive equipment—first in increasing worker efficiency. It collects and filters dust and grit from grinding and buffing wheels, returns the air fresh and pure. Fits any make grinder; now available in three sizes: for wheels up to 10", 1½" face, $125; over 10" and up to 14", 3" face, $150; over 14" and up to 24", 3" face, $190. Easy to install. Write today for bulletin—stating your requirements. Satisfaction guaranteed!

The Cincinnati

ELECTRIC DRILLS • GRINDERS • BUFFERS • PORTABLE TOOLS

The Cincinnati Electrical Tool Co.

Madison Rd., Cincinnati, O.

UP TO THE MINUTE...

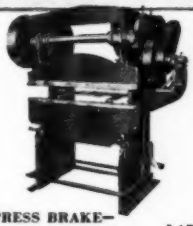
Chicago Steel Brakes Are Modern in Design and Sturdy Construction

BOX AND PAN BRAKE—
Forms boxes or pans from one piece of metal. A straight brake as well as a box brake. Ideal for experimental shops.

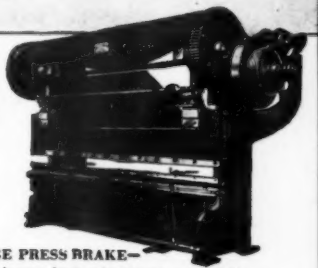
HAND BRAKE—
Improved to meet modern needs. Efficient and dependable — sturdy and durable.

POWER BENDING BRAKE—
Indispensable wherever a volume of heavy plate work is done—forms a great variety of bends and shapes without dies.

We manufacture any type of die required for forming presses. Our die department will quote on any type to meet your needs. Submit blue print or sample of work.



SMALL PRESS BRAKE—
Compact, powerful money-saving production unit. Replaces cumbersome costly machines that are expensive to operate. Uses same dies as larger machines.



LARGE PRESS BRAKE—
The only press brake which turns out perfect work without shims and crowned dies. Patented non-deflecting bed equalizes pressure over the full bending length and overcomes major faults in solid bed press brakes.

36 Years' Experience..

building STEEL CONSTRUCTED sheet metal working machines are behind each CHICAGO BRAKE. They're built to give years of service.

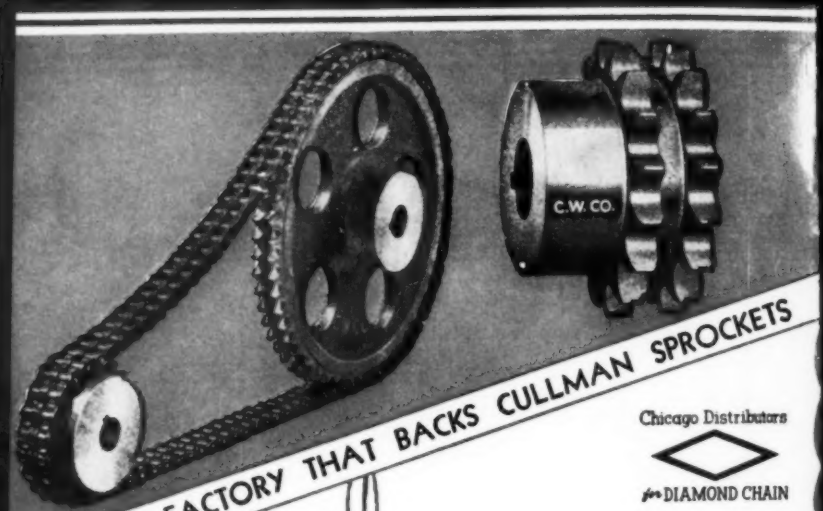
ALL CHICAGO BRAKES are built of rolled steel welded sections which insure great strength, accuracy and long life. They are the most modern tools in design and workmanship to fit today's need for fast production sheet metal working machinery.

We Are The World's Largest Manufacturers Of Hand Bending, Power Bending And Power Press Brakes.

Aside from the CHICAGO line, we have built many special machines for intricate bending operations. Take advantage of our many years' experience by sending us any difficult bending problem you have.

DREIS & KRUMP MFG. CO.
7440 LOOMIS BLVD., CHICAGO, ILL.

OVER 40,000 "CHICAGO" BRAKES in use by leading concerns the world over



THE FACTORY THAT BACKS CULLMAN SPROCKETS

Chicago Distributors
for DIAMOND CHAIN

HERE is where Cullman Sprockets are made—for all types of chains, standard or non-standard—over 45,000 in stock.

HERE, too, is the home of Cullman Speed Reducers—Single, Double, Quadruple Types.

LAST, but far from least, here you will find Cullman Drives being manufactured—a simple device that transforms old cone pulley machines into modern, motor driven equipment.

YES, this is the factory that backs Cullman products, and, in turn, the *products that back the factory.* Catalogs on any or all of the above items are yours for the asking.

THE CULLMAN WHEEL CO.
1359 Altgeld St., Chicago, Ill